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THE THERMIONIC VALVE IN SCIENTIFIC RESEARCH¹

By Sir AMBROSE FLEMING

EMERITUS PROFESSOR OF ELECTRICAL ENGINEERING IN THE UNIVERSITY OF LONDON

THE thermionic valve, which as a technical invention has made possible the great achievements of telephonic broadcasting and television, arose out of scientific research intended to elucidate certain observed phenomena in connection with the working of incandescent electric lamps in 1882 and 1883. It has also provided in itself a new and valuable instrument of research for physical investigation. The initial steps were taken in this invention when the writer as scientific adviser of the original Edison Electric Light Company of London began to study the projection of carbon atoms from the carbon filament of the then used Edison car-

bonized bamboo filament electric lamps, which, together with the carbonized cotton thread incandescent lamps of Swan, provided the first practical domestic electric lighting system for general use. It was soon found that these lamps had a black deposit made on the interior of the glass bulb in course of time which was fairly uniform and was doubtless due to an evaporation of the carbon, which substance like iodine and camphor and some others passes from the solid state to the gaseous without any intermediate liquid state.

On the other hand, in certain cases in which a line of no carbon deposit appeared on the bulb in the plane of the hairpin-shaped carbon filament, it was evident that the projection of carbon particles had taken place from one particular overheated point on the filament. This projection was due to a process of electric "splut-

¹ Abstract read by Dr. Howard McClenahan, secretary and director of The Franklin Institute, at Medal Day Exercises in the institute when Sir Ambrose was awarded the Franklin Medal.

tering" which was also the cause of a green copper deposit on the bulb in some cases, since in the Edison lamps the ends of the carbon filament were well connected to the platinum leading-in wires by an electrodeposit of copper over the clamp. This carbon spluttering then clearly took place along straight lines by reason of electric repulsion of carbon ions carrying an electric charge.

Edison had noticed in 1883 that when a metal plate carried on a wire was sealed through the bulb of his carbon filament lamp and connected externally to the lamp by a circuit joined to one or other terminal of the filament, an electric current flowed in this circuit if it terminated on the positive terminal of the lamp filament which was heated by a direct voltage but little or no current when the current terminated on the negative terminal of the filament. The author of this paper made an extensive investigation of the cause of this effect which Edison had not explained or utilized. This was published in 1896 in the Proceedings of the Physical Society of London and in the *Philosophical Magazine* for July, 1896.

In this paper an extensive set of experiments was described which proved that certain particles charged with negative electricity were being ejected from the incandescent filament of carbon or from metal wires raised to incandescence in an evacuated bulb. It was at first assumed that these carriers were atoms or ions of carbon. It was proved that they were material particles of some kind, but it was not until four or five years later that Sir Joseph Thomson showed that they were the particles of ultra-atomic size we now call electrons.

Amongst the experiments described was one in which a grid formed the positively charged anode plate by which the electrons shot off from the filament were collected.

It was then proved in the above-mentioned paper that if a highly evacuated glass bulb had in it one hot carbon and one cold metal electrode the space between had a unilateral electric conductivity and could convey negative electricity from the hot cathode to the cold anode but not in the opposite direction. A large variety of experiments supported this conclusion.

No additional uses or practical application of this fact was made until after the advent of electromagnetic wave telegraphy, when it became evident that it would be necessary to replace the capricious and easily disturbed coherer by some more certain device as a detector of the feeble high frequency electric currents or voltages induced in the receiving aerials of wireless telegraph apparatus.

The writer then made in November, 1904, the type of rectifying electronic valve since associated with his name, which converted these small alternating currents

into direct currents which could be detected by galvanometers or telephone receivers and thus made signal-detecting instruments in this system of wireless telegraphy. It consisted of a carbon-filament vacuum lamp having a metal cylinder round the filament, the said cylinder being carried on a wire sealed through the wall of the glass bulb. This Fleming rectifying valve came immediately into extensive use by Marconi's Wireless Telegraph Company in England as a practical wireless detector. It preceded by two years the invention of the first crystal rectifying detector of H. H. C. Dunwoody, namely, the carborundum crystal detector.

It is frequently stated that the early Fleming valves were merely low vacuum, or as we should now say, soft valves. This, however, is quite incorrect. In one of the writer's British Specifications it is clearly stated that a high vacuum is to be made in the bulb, and as a matter of fact some of the earliest valves made were exhausted by the use of the beautiful process of Sir James Dewar, in which the high vacuum is made by the absorptive power for gases of cocoanut charcoal cooled with liquid air.

In this case the electric current in the valve is wholly conveyed by electrons emitted by the incandescent filament and not by ionization of residual gas atoms in the bulb. It was not then a subsequent invention to create what is now called a "hard" valve. Some of the earliest experimental thermionic valves were quite hard. The writer also showed that by the use of two such rectifying valves both phases of an alternating current could be rectified or converted to direct currents. The addition of the "grid" between the "plate" or anode and the incandescent filament which converts the rectifying valve into an amplifying valve was first described by Lee de Forest in his United States patent of 1908, dating, however, under the convention as from January 29, 1907. But the strange thing is that this British patent for an important improvement was allowed to lapse in 1911, whereas it could have been maintained for fourteen years from the date of application in England by payment of fees.

When we speak of an electron as "particle," that immediately raises the question, What is this particle made of? And even if we assume the existence of subelectrons, we ask what they are made of, and so on. The same for photons often asserted to be "particles" or "quanta" of energy.

The new quantum theory suggests to us that we must think of electrons as wave groups in a medium and that may involve that the so-called motion of an electron is not a bodily movement of something retaining a constant individuality but the cessation of some kind of wave in one place and its recreation in another. The photon on the other hand may be regarded

simply as a singularity on the wave front of the light, a locality where the amplitude of the light vectors is greater than the average, thus giving, as Sir Joseph Thomson called it, a "speckled" appearance to the wave front. As the wave passes over atoms it is only at these singularities that the energy is great enough to cause a possible elevation of an orbital electron to an orbit of greater potential energy.

We must bear in mind, however, that the mental pictures we are able to form of physical events are in any case only symbols or hieroglyphics and may bear no more resemblance to the actual event or phenomena than the written or printed marks which form what we call a "word" bears to the form of the thing that word denotes.

Our mental pictures are made up necessarily of fragments of past sense impressions, and the more easily or clearly we can build up a mental picture of a physical event the less it is likely to be true to fact. In any case it only suffices for a certain limited time and then has to be thrown on one side. Thus the Thomson mental picture of an atom was superseded by that of Bohr and that of Bohr by that of Schroedinger and that in turn by some yet unimagined conception.

We pass on then to mention some other interesting applications of the thermionic valve in scientific research, and one of these is due to Dr. R. Whiddington, Cavendish professor of physics in the University of Leeds, described in the *Philosophical Magazine* of November, 1920. If in a three-electrode thermionic valve or triode, as it is often called, we couple inductively by a transformer the grid and the plate or anode circuits, and if the latter includes a capacity inductance closed circuit of low resistance, then oscillations are set up in this circuit determined by the capacity and inductance.

If a second valve oscillator is set up having a condenser of capacity which is adjustable, we can arrange that the frequency difference of the two sets of oscillations comes within the audible range and creates "beats." These can be amplified by a valve amplifier and made to actuate a loud-speaking telephone so that the beats per minute can be easily counted. If then the capacity is varied by altering the distance between the plates of the condenser even by a very minute amount there is a change of beat frequency which can be counted and by which the change in the interdistance can be measured.

Professor Whiddington found that it was quite possible to detect a change in distance between the plates of two to four thousandths of a millionth of an inch in the interdistance of the flat condenser plates. The plates were normally about one thousandth of an inch apart.

This apparatus is therefore capable of detecting a movement of the condenser plates to or fro of about

1,200 of a millionth of an inch, which is far less than that of a Whitworth screw micrometer. It could also be used to detect exceedingly small changes in dielectric constant of certain highly insulating liquids.

This invention can be applied in the design of many different instruments, as for instance in the construction of a microbalance where the tilt of the balance beam due to a weight is made to alter the distance between two condenser plates.

Other interesting applications of the thermionic valve in research are in the construction of instruments for measuring small high frequency voltages, currents and powers. The defect of all alternating current instruments depending on the heating power of the current is that as this heating varies as the square of the current the scale readings decrease more rapidly than the current.

Amongst such thermionic valve instruments may be mentioned the Moulin voltmeter, which enables the peak voltage and mean value of an alternating current of any wave-form to be measured by the same instrument. E. B. Moulin described this instrument in August, 1928, in the *Journal of the Institution of Electrical Engineers* (Vol. 66, p. 886, 1928). It consists of a thermionic valve with filament heated by a 4-volt storage battery and the terminals to which the tested alternating voltage is applied connected to the grid and filament respectively of the valve, one through a high resistance shunted by a condenser for grid connection and a direct microammeter for the filament connection. This instrument has the great virtue that it absorbs little or no power. It is made in various forms by the Cambridge Instrument Company of England.

A very ingenious application of the three- or two-electrode valve has been made by Dr. H. E. M. Barlow in the construction of a valve ammeter for the measurement of small alternating currents of radio frequency. (See *Journal of the Institution of Electrical Engineers of London* for March, 1925. Paper first received in February, 1924).

He constructs a Wheatstone's bridge circuit, two arms of which are formed of the interspace filament-to-grid or filament-to-plate of two thermionic valves. The other two arms are suitable resistances, and a suitable microammeter is put in the bridge circuit and a high tension battery supplies current as usual to the circuits. A balance can then be obtained. The filaments of the valves are rendered incandescent by a suitable E.M.F. with a highly inductive coil in series. If, then, a small alternating current is superimposed on the direct filament heating current of one valve it upsets the bridge balance and causes a deflection of the microammeter.

It is then possible to calibrate the instrument so that

the readings of the bridge ammeter give the strength of the alternating current added to the direct heating current of one valve, and such calibration is valid for all frequencies.

It is made to give full scale deflections for A.C. currents of 5, 10, 20 or 30 milliamperes. Dr. Barlow has also made a useful arrangement of two electrode valves for measuring very small condenser capacities.

A thermionic wattmeter has also been devised by Dr. E. Mallett, in which two thermionic valves and a dif-

ferential galvanometer are employed. But instruments of this type in which two valves of quite identical characteristics and a differential galvanometer are requisite are not very likely to come into any general use for commercial purposes.

The application shows, however, the extensive possibilities of the thermionic valve as an instrument for scientific research outside of and beyond its technical applications and general employment as an amplifier of voltage.

THE ELECTRONIC THEORIES OF LEWIS AND KOSSEL¹

By Professor WILLIAM A. NOYES
UNIVERSITY OF ILLINOIS

IN March and April of 1916 Kossel in Germany and Lewis in America proposed, quite independently, theories of the function of electrons in chemical combination, which have many ideas in common. Beginners in science and some older persons fail to understand the very complex nature of such theories at the outset and that as the years pass the theory is amplified and changed, slowly approaching, as we believe, the fundamental realities in the material universe. They always remain an imperfect expression for these realities, but those who have watched their development—how the changes are the result of the work of literally hundreds of different persons and how the important ideas of which the theories are made up are constantly checked by experiments of the most varied sorts find it difficult to believe that there is not a rather close correspondence between the ideas of the theory and actual facts.

The two theories had a common background, furnished, at basis, by the idea of Dufay, now two centuries old, that there are two kinds of electricity each having an attraction for its opposite and a repulsion for its own kind. The discovery of the electron, the atom of negative electricity, may be said to have begun with Faraday's experiments on the relation between electricity and chemical atoms a century ago, Helmholtz's interpretation of Faraday's experiments fifty years ago, Crookes's discovery of cathode rays in the late seventies and the determination of the mass of the electron by J. J. Thomson and by Kaufmann in 1897. Fourteen years later, Rutherford, by shooting positive alpha particles through a thin film of gold and noting their deflection, demonstrated that the positive portion of an atom is very small in comparison with the size of the atom. This, together with the known mass of

the electron, one eighteen-hundredth of the mass of a hydrogen atom, showed that both the positive charge of an atom and nearly the whole of its mass are concentrated in the small nucleus at its center. Soon after, Moseley based the atomic numbers of the elements on the x-ray spectra from two electrons located close to the nucleus of each atom. The rotation of these electrons about the nucleus is more rapid as the electrons are drawn closer in when the positive charge is increased by one unit in passing from one atom to the next in the periodic system.

These ideas, which I have sketched very briefly and incompletely, gave the background on which Bohr and others based the theory of the structure of atoms as consisting of a central nucleus surrounded by successive groups of 2, 8, 18 and 32 electrons, but always with 8 electrons in the outer shell of a noble gas. These historical facts help us to understand how two men, 7,000 miles apart, should have proposed, independently, theories which have so many items in common.

The theories were proposed in 1916, during the great war, and soon after, Lewis and Kossel were on opposite sides in the world conflict. We may be sure that their theories will soon be fused together into a consistent, generally accepted whole. May we not take this as an omen that Hitler and Eden, who were in trenches just across the battle line, may help to piece the fragments together and build that permanent world peace which we so earnestly desire.

So far as I am aware, the first attempt to connect electrons with chemical phenomena was made by Lewis in March, 1902, when he was teaching elementary chemistry and drew in his notebook the crude figures which developed into his "cubical" atom. He considered the theory too speculative and waited fourteen years before he published it. J. J. Thomson, in 1904, proposed the hypothesis that an atom consists of a

¹ Presented before the Division of Physical Chemistry of the American Chemical Society, April 26, 1935. A comprehensive historical sketch of electronic theories will appear in *Chemical Reviews* for August.

uniform sphere of positive electrification within which electrons move about. He worked it out with elaborate mathematical detail. This will always remain a good illustration of the futility of mathematics when it is based on a false hypothesis. He contributed, however, the very important idea that atoms may be held together by static attraction due to the transfer of an electron from one atom to another. This is still a part of every electronic theory.

Abegg, in 1904, proposed a more qualitative theory in connection with his ideas of "principal" and "contra" valences. Abegg's ideas influenced both Kossel and Lewis.

The most important common idea contributed by both Lewis and Kossel was that every atom has a strong tendency to assume the stable form of a noble gas near it in the periodic system, by the gain or loss of one or more electrons. This led Kossel to a formula for the perchlorate ion in which the chlorine atom had assumed the structure of neon by the loss of seven electrons, and each oxygen atom had also assumed the structure of neon by the gain of two electrons.

While Lewis assumed that atomic ions may be formed in the same manner that was assumed by Kossel he added the thought that the noble gas structure may be formed in compounds by sharing pairs of electrons which belong in common to the atoms held together. Later, Langmuir used the term "covalence" to designate the pair of electrons. According to Lewis, the chlorine of the perchlorate ion has the structure of argon and has four covalences, while each oxygen atom has the structure of neon and has one covalence. Lewis called the portion of the atom within the group of valence electrons the "kernel." The kernel of chlorine has a positive charge of seven units and that of oxygen a positive charge of six units.

The electrons of a covalence are not equally shared by the two atoms, when these are different, but Lewis did not point out clearly that, so far as atoms at a distance are concerned, a covalence balances one positive unit charge in each atom. From this point of view, four of the seven positive charges of the chlorine kernel are balanced by the covalences and three are

balanced by the negative electrons associated with the oxygen atoms. Since each oxygen atom with a single covalence has a residual negative charge of one unit the four oxygen atoms give a negative charge of one unit to the perchlorate ion. Reasoning of this sort enables us to select atoms in compounds, which have a residual positive or negative charge when we know their electronic structure. Kossel's theory does not have this advantage.

In 1901 Stieglitz, on the basis of the work of Jakowkin, recognized that the reaction between chlorine and water is ionic in character and assumed that the chlorine molecule separates into positive and negative ions. This is easily explained by assuming that when the atoms of a chlorine molecule separate the covalence electrons remain with one of the atoms. This prepares us to understand that two atoms held by a covalence may separate in three ways: (1) The electrons may go with the first atom, making that negative; (2) they may go with the second atom, leaving the first atom positive; (3) one electron may go with each, which will then be neutral.

Some interpretations of the wave quantum mechanics have replaced Lewis's cubical atoms by the tetrahedral arrangement which had been accepted by organic chemists sixty years ago on the basis of the work of Pasteur, Le Bel and van't Hoff. This has also given a picture of the relation of covalence electrons to the atoms held together which recalls the inclusive orbits suggested in a crude way by the author in 1917 and in a much better form by Campbell, Sidgwick and Knorr in 1923.

The facts that the carbon atoms of a doubled covalence are closer together than those of a single union and that the double bond increases the molecular volume of the compound indicate that the four electrons spread out on the two sides because of the tendency toward a tetrahedral structure. This recalls the old explanation for the cis-trans structure, and Baeyer's treatment of the double union as the limiting case for rings.

It will be seen from the above that Lewis's theory furnishes a simple explanation for many facts which are not so easily reconciled with the theory of Kossel.

OBITUARY

LUCIAN W. CHANEY

LUCIAN W. CHANEY was graduated at Carleton College in the class of 1878. He continued his studies for three years and then joined the faculty of his alma mater in 1882. In the following year he was made professor of biology and geology.

These were years of beginnings for Carleton, and the department to which Professor Chaney was appointed needed to be created by him. He was one of a group of Carleton's earliest faculty members who are known as the "Old Guard," who laid the foundation for high scholarship and character in the young college.

Professor Chaney's task in those early years was a heroic one. There were no microscopes or other equipment for laboratory work in biology, but he organized his courses with thorough laboratory instruction. He himself sought gifts and he and his family denied themselves necessities in order that he might save from a meager salary to buy precious instruments which he needed for his students. Those of us who had our work with him in the nineties look back to our courses with Professor Chaney with thorough satisfaction and the conviction that the courses in botany which we had with him in his little basement laboratory compare very favorably with modern courses with all their elaborate equipment.

Professor Chaney was both an able teacher and a good friend of every student in his courses. He gave free scope to the student's initiative to do things for himself. But he was always ready with sound advice and help when it was needed, and it was given in a spirit of friendly cooperation.

Professor Chaney also was interested in the students' social life. He may be justly considered the father of Carleton's athletics. This was also accomplished by letting the students do for themselves, while he was always behind the scenes ready with friendly advice and counsel. When Carleton had no athletic budget, Professor Chaney canvassed alumni friends with personal letters every year to raise a modest sum to help the boys.

Professor Chaney's work in geology was also of high character. The museum of geology and mineralogy which he organized was an excellent piece of work and was one of the show places on the Carleton campus. His explorations with Dr. Lyman B. Sperry in the Montana Rockies and their discovery of the glaciers in what was made later Glacier National Park were achievements of high merit.

Professor Chaney retired from the Carleton faculty in 1908, after twenty-five years of service, upon a pension from the Carnegie Foundation. But his great qualities as finder of facts, his clear scientific analysis, his deep interest in human welfare, his complete unselfishness and devotion to truth were still to find a new field of service of equal importance and wider scope. For almost another quarter century he labored in the Federal Bureau of Labor Statistics as a pioneer in the realm of fact-finding and analysis to reduce industrial accidents. Dr. Chaney's achievements as a pioneer in two widely different fields speak eloquently concerning his clear-sighted intellectual qualities, his rectitude and his human sympathy and appreciation. He was a fine product of pioneer life of the West. His achievements are his monument.

FRANZ F. EXNER

CARLETON COLLEGE

SAMUEL HENRY ESSARY

PROFESSOR SAMUEL HENRY ESSARY, botanist of the Tennessee State Experiment Station at Knoxville, died suddenly of a heart attack on April 28.

Professor Essary was a descendant of pioneer stock in the western part of Tennessee. He was born at Chesterfield in 1870, the eldest of five children. He never married. After graduating from Union University, Jackson, Tennessee, he entered the University of Tennessee, taking the degree of master of science in 1907. Subsequently he studied for some time at the University of Wisconsin. His teaching experience in his earlier years included instructorships at La Grange College, Missouri, and Brenau College, Georgia. He then became associated with Professor S. M. Bain at the University of Tennessee, as instructor in botany, following him to the newly established State Experiment Station. After Professor Bain's death in 1918, Professor Essary became station botanist and head of the department.

Continuing the work begun by Professor Bain, in the development of anthracnose-resistant red clover, Professor Essary developed what is looked upon as the best red clover south of the Ohio River. His careful selection has given to the South "Tennessee 76" lespedeza, most valuable as a hay and pasture crop. His "Tennessee Red" and "Tennessee Pink" tomatoes, selected for wilt-resistance, have proved a boon to the truck farmers of the state. Forage and legume crops also held his close attention, and the work he did in selection for regional adaptation and economic usefulness along these lines is of undoubted value.

For several years past he had been devoting considerable time to the selection and breeding of cotton. "Trice," one of the best varieties grown along the northern cotton belt, is one of his improvements.

As a scientist his position is well established. But he was also a true naturalist, gifted with keen insight and unusual powers of observation. He knew thoroughly the Great Smoky Mountains and was a pioneer in blazing several of the trails included in the National Park. He was an excellent photographer, and many of his mountain pictures have appeared in newspapers and magazines all over the country. His botanical knowledge of the mountain flora made these of superlative worth. He left a botanical collection extending over forty years.

He was a most lovable man and his friends were deeply attached to him. Unobtrusive and unselfish, he never tried to advance himself, but was always extending a helping hand to others, especially younger men, about him. In his daily association with Professor Essary over a period of thirteen years the present writer grew to regard him as an elder brother in affection and a wise counselor in mutual undertakings.

LUDWIG STOLZ MAYER

RECENT DEATHS

DR. CHARLES RUSSELL BARDEEN, since 1904 professor of anatomy and since 1907 for twenty-eight years dean of the University of Wisconsin Medical School, died on June 12 at the age of sixty-four years.

DR. WILLIAM THOMAS MAGRUDER, professor of mechanical engineering emeritus at the Ohio State University, died on June 21. He was seventy-four years old.

DR. ROBERT H. HUTCHINSON, JR., associate professor of the Department of Otolaryngology in the New York Post-Graduate Hospital Medical School, died on June 21 at the age of fifty-six years.

DR. J. G. ESTES, professor of mathematics at North

Carolina State College, was killed on June 1 when his plane crashed at the Raleigh airport.

A CORRESPONDENT writes: "B. F. Loomis, of Anderson, Calif., died on June 11 at the age of seventy-eight years. He was known principally for his photographic recording of the eruptions of Lassen Peak from 1914-17. His own version of the eruptions was published in a well-illustrated volume under the title 'Pictorial History of Lassen Volcano.' Mr. and Mrs. Loomis donated the equipped buildings and the grounds for the museum in Lassen National Park."

DR. JULIUS BEREND COHEN, professor of organic chemistry at the University of Leeds from 1904 until 1924, died on June 10 at the age of seventy-six years.

SCIENTIFIC EVENTS

OXFORD UNIVERSITY OBSERVATORY

A CEREMONY of inauguration of the new solar telescope took place on June 11 at the University Observatory, Oxford, in which Sir Arthur Eddington delivered an address on "The Physics of the Sun." This instrument, according to the *London Times*, has been provided by the university in order that the observatory may have equipment adequate for the study of some phase of modern astronomy, which is to be taken to mean the study of the physical nature and constitution of the stars as distinct from their positions, distance, brightness and distribution which had been the work of the previous directors, Professor Pritchard and Professor Turner. The present occupant of the Savilian chair of astronomy and director of the observatory, Professor H. H. Plaskett, interprets this as calling for the study of the sun, the nearest of the stars, as a beginning, and has designed this solar equipment for investigation of the problems of the sunspots, low temperature areas and the magnetic fields surrounding them, and the rotation of different surface zones of the sun.

The instrument, made by the firm of Sir Howard Grubb Parsons Company, of Newcastle, with optical parts by Adam Hilger, of London, is essentially a small tower stationary telescope with five silver on quartz mirrors, the first of them which receives the light being a plane coelostat mirror 16 inches in diameter, while the effective concave mirror is 12 inches. The result of the total combination is a stationary image of the sun about 8 inches in diameter that will be studied by means of a prism spectroscope, specially chosen in preference to a grating, that will give a high resolving power. Advantages claimed for the instrument are first its compactness, secondly the fact that the mirrors are of quartz which has a coefficient of

expansion one twentieth that of ordinary glass and would therefore give a small deformation of the image compared with other mirrors, and thirdly the large size of the prisms of the spectroscope. The astrographic catalogue work that has been in hand for many years at the University Observatory is proceeding under Mr. Bellamy and, though there has been no addition to the permanent staff, graduate members of the university and others have been engaged in research work in astrophysics at the observatory during the past year.

THE DAVID DUNLAP OBSERVATORY

THE David Dunlap Observatory, which was officially opened on May 31 in the presence of a group of world-famous astronomers, is the gift of Mrs. Jessie Donald Dunlap to the University of Toronto in memory of her husband, David Alexander Dunlap. The observatory is under the directorship of Professor C. A. Chant, head of the department of astronomy at the university, who, during the past thirty years, has trained the majority of Canadian astronomers and to whom is largely due the present interest in astronomy throughout Canada.

The Dunlap Observatory is situated on a slight rise fifteen miles north of Toronto at an altitude of 800 feet above sea level. The grounds of the observatory consist of 179 acres which will later be developed into a park. The observatory buildings include the administration building of white stone surmounted by three copper-covered domes and, 50 yards to the north, the large 61-foot dome. The latter houses the chief instrument of the institution, a 74-inch reflector by the Sir Howard Grubb Parsons Company. This telescope is at present second only to the Mt. Wilson 100-inch. The main mirror is a disk of Pyrex, 76 inches in diameter and just over a foot thick, cast by the Corning

Glass Company of Corning, N. Y. The telescope is equipped with a single prism stellar spectrograph by Hilger. Regular observation with this instrument was commenced early in June.

The administration building contains offices, library, machine shop, laboratories and lecture room. In the south dome is mounted a 19-inch reflector constructed by Professor R. K. Young, assistant to Professor Chant. The remaining two domes are at present empty, but it is hoped eventually to have a 12-inch refractor in one and a battery of short-focus photographic telescopes in the other.

The program of the observatory will be largely spectrographic in nature and will include studies of the radial velocities and physical constitution of stars fainter than sixth magnitude. Some direct photography at the Newtonian focus is planned, however, as the 74-inch telescope can conveniently be used with either the Newtonian or Cassegrainian arrangements. It is planned to reserve Saturday evenings for the public when those interested will have a chance to look through the telescope. In addition to this the observatory buildings will probably be open for inspection on certain afternoons during the week.

Mrs. Dunlap has, through her generous gift, provided the University of Toronto with an institution eminently suited for astronomical research of the highest importance.

THE HARVARD MINERALOGICAL MUSEUM

THE Harvard Mineralogical Museum has recently acquired the major part of the collection of Dr. Hans von Karabacek, of Vienna. Much of the new material has not been represented in the Harvard collection, and it is said that the acquisition is the most notable the museum has received since the bequest under the will of Albert F. Holden, '88, who died in 1913.

The new collection includes a large suite of the finest crystallized minerals from the copper mines of Tsumeb in German Southwest Africa. That locality is noteworthy for the variety and beauty of the compounds of lead, copper and zinc and the minerals secured are probably the finest specimens saved during the mining operations which have now ceased.

Professor Charles Palache, curator of the Mineralogical Museum, says of the new collection:

Of the nine cuprites (oxide of copper), one is probably the finest specimen of this mineral ever found anywhere.

There are some fifty specimens of azurite and malachite, the carbonates of copper. The more than fifty specimens of the carbonate of lead, cerussite, and the twelve specimens of the sulphate of lead, anglesite, are not only the

finest of their kind, but no two are identical. Twelve specimens of wonderfully colored carbonate of zinc, smithsonite, are also unusual.

Next in importance to these in the collection is a magnificent suite of fluorites from the long extinct mines of Cornwall in England, which are of extraordinary beauty, form and coloring.

Other suites worthy of mention are nearly thirty crystallized hematites from European localities; twenty specimens of epidote from the most famous Alpine locality for this mineral; five emeralds, each better than any hitherto in the collection, and a beautiful suite of titanite from the Alps.

Most of the specimens were selected because of their unusual quality. There were, however, a number of minerals not uncommon and not of particularly fine quality, but representing localities, mostly European, unrepresented in our collection.

THE CORNELL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

THE summer convention of the American Institute of Electrical Engineers, which was held at Cornell University from June 24 to 28, brought together more than 1,500 electrical engineers from all parts of the United States and foreign countries. This is the first time that the institute has held its convention at a university. Professor Robert Franklin Chamberlain was chairman of the convention committee.

The American Institute of Electrical Engineers has a membership of over 15,400 engineers in the United States and throughout the world. Its object is the advancement of the theory and practice of electrical engineering and of the allied arts and sciences and the maintenance of a high professional standing among its members.

Among the events were an address of welcome by Dr. A. R. Mann, provost of the university; the award of several prizes for papers; reports of progress in electrical devices which protect homes against burglars and kidnapers; an inspection of the Cornell campus, and of the largest telescope mirror in the world at the Corning Glass Works.

There was also a discussion of the rôle of the electrical engineer in a changing world, and of how he can apply his scientific knowledge to solve social and economic problems. A round table discussion was arranged on the problems of student and cadet engineers.

Professor Takai, of the University of Tokyo, gave an address on the electrochemical and electrometallurgical industries of Japan and several papers were presented discussing the Boulder Dam hydro-electric project. A brief outline of the program follows:

TECHNICAL CONFERENCES

Subject	Chairman
Problems of the Student and Cadet	
Engineer	M. G. Malti
D. C. Test Code	R. W. Owens
Transformers	J. E. Clem
Research on Insulating Oils	K. S. Wyatt
Noise	P. L. Alger
Mercury Arc Rectifiers	O. K. Marti
Dielectric Theories	H. H. Race
Circuit Breaker Standards	R. T. Henry
Reactance of Synchronous Machines	C. M. Laffoon
Electrical Engineering Curricula and Educational Methods	V. Karapetoff
Distribution Transformer Protection	K. B. McEachron
Tensor Analysis	E. E. Dreese
Conductor Vibration	D. M. Simmons

TECHNICAL SESSIONS

Instruments in Measurements	W. B. Konwenhaven
Power Generation	H. W. Leitch
Electrical Machinery	V. M. Montsinger
Protective Devices	H. P. Sleeper
Education	L. A. Doggett
Application of Electricity to Iron and Steel Production	R. W. Graham
Electrochemistry and Electrometallurgy	N. R. Stansel
Power Transmission	D. M. Simmons

HONORARY DEGREES CONFERRED BY HARVARD UNIVERSITY

TWELVE honorary degrees were conferred by Harvard University at its commencement on June 20. These included the doctorate of laws on Henry Agard Wallace, Secretary of Agriculture; on Dr. John Campbell Merriam, president of the Carnegie Institution of Washington, and on Dr. George Sarton, lecturer on the history of science at Harvard University. The doctorate of science was conferred on Dr. Albert Sauveur, McKay professor of metallurgy; on Dr. Waldemar Lindgren, emeritus professor of economic geology at the Massachusetts Institute of Technology; on Dr.

Charles Schuchert, emeritus professor of history and geology, Sheffield Scientific School, and curator of geological collections, Peabody Museum, Yale University, and on Dr. Albert Einstein, of the Institute for Advanced Study at Princeton, N. J. The degree of master of arts was conferred on Dr. Walter Prentice Bowers, physician.

The citations made by President Conant in conferring the degrees are as follows:

DOCTOR OF LAWS

HENRY AGARD WALLACE, doctor of laws—A public servant of deep faith and high integrity, who finds courage to attempt an uncharted journey in our modern wilderness.

JOHN CAMPBELL MERRIAM, doctor of laws—A distinguished scientist whose wise administration of the Carnegie Institution has advanced knowledge on many fronts.

GEORGE SARTON, doctor of laws—Historian of science and of learning, a scholar whose relentless toil and inspired vision are creating a new academic discipline.

DOCTOR OF SCIENCE

ALBERT SAUVEUR, doctor of science—Long famous as a founder of the science of metallography, a Harvard professor of whose achievements we shall be forever proud.

WALDEMAR LINDGREN, doctor of science—A geologist to whom all men turn for knowledge of the metallic secrets hidden in the rock.

CHARLES SCHUCHERT, doctor of science—Eminent paleontologist of Yale, who has mapped the ancient seas and fathomed the geologic past.

ALBERT EINSTEIN, doctor of science—Acclaimed by the world as a great revolutionist of theoretical physics, his bold speculations, now become basic doctrine, will be remembered when mankind's present troubles are long forgotten.

MASTER OF ARTS

WALTER PRENTICE BOWERS, master of arts—A physician devoted to his calling, for more than forty years a general practitioner in Worcester County, he has brought skill and wisdom to countless homes.

SCIENTIFIC NOTES AND NEWS

THE American Association for the Advancement of Science and the associated scientific societies are meeting this week in Minneapolis. A full report of the meeting together with some of the more important addresses and papers will be printed in early issues of SCIENCE.

DR. IRVING LANGMUIR, associate director of the Research Laboratory of the General Electric Company, Schenectady, N. Y., has been elected a foreign member of the Royal Society, London.

DR. THOMAS HUNT MORGAN, director of the Wm. G. Kerekhoff Laboratories of the California Institute

of Technology at Pasadena, has been elected a corresponding member of the Prussian Academy of Sciences.

DR. E. D. MERRILL, for the past six years director of the New York Botanical Garden, has accepted appointment as professor of botany and administrator of botanical collections at Harvard University. His work will involve the administration of the several independent botanical units of the university, including the Arnold Arboretum, the Gray Herbarium, the Farlow Herbarium and Library, the Botanical Museum, the Botanic Garden, the Bussey Institution and the Harvard Forest.

DR. WILLIAM OTIS HOTCHKISS, since 1925 president of the Michigan College of Mining and Technology, previously for six years state geologist of Michigan, has been elected president of Rensselaer Polytechnic Institute. He succeeds the late Palmer C. Ricketts, who had been president since 1901.

DR. HENRY NORRIS RUSSELL, professor of astronomy and director of the observatory of Princeton University, delivered the George Darwin Lecture at a meeting of the Royal Astronomical Society on June 14, taking as his subject "The Analysis of Spectra and its Applications."

DR. RALPH HOWARD FOWLER, Plummer professor of mathematical physics at Trinity College, Cambridge, England, has been appointed visiting lecturer in mathematics at Princeton University for the second term of next year.

THE Susan Colver Rosenberger Medal, given each year to an alumnus of Brown University for distinguished service to humanity, has been awarded to Dr. Charles V. Chapin, for forty-two years superintendent of the department of health of Providence, R. I.

THE Leeuwenhoeck Gold Medal of the Royal Academy of Sciences, Amsterdam, has been awarded to Professor S. N. Winogradsky, director of the Division of Agricultural Microbiology of the Institut Pasteur, Brie-Comte-Robert, France, for his contributions to the development of soil microbiology. The medal is awarded every ten years in commemoration of the discovery of microorganisms by Anton van Leeuwenhoeck.

At the University of Wisconsin the degree of doctor of laws was conferred at commencement on Dr. James Bryant Conant, president of Harvard University, and the degree of doctor of science on Professor Gilbert Ames Bliss, head of the department of mathematics of the University of Chicago.

DR. ISAAH BOWMAN, president-elect of the Johns Hopkins University, received the degree of doctor of laws at the commencement of Dartmouth College.

THE honorary degree of doctor of science was conferred on James T. Jardine, chief of the Office of Experiment Stations, U. S. Department of Agriculture, by the Kansas State College of Agriculture and Applied Science, at its commencement exercises on May 27.

THE University of Colorado at commencement conferred the degree of doctor of science on Dr. Florence Rena Sabin, member of the Rockefeller Institute for Medical Research; the degree of master of science was conferred on Darwin Andrews, horticulturist and botanist of Boulder.

DR. HAROLD CLAYTON UREY, professor of chemistry at Columbia University, received the degree of doctor of science at the commencement exercises of Princeton University. In presenting the degree, Professor L. P. Eisenhart, dean of the graduate school, spoke as follows: "Harold Clayton Urey, professor of chemistry in Columbia University, awarded the Nobel Prize in chemistry for his discovery that ordinary hydrogen gas is not simple, but contains a second isotope of mass two; subsequently, in collaboration with the late Dr. Edward Washburn, he located abundant sources of the new hydrogen in electrolytic cells and devised a method to produce pure heavy water in quantity; a bold investigator with a mastery of advanced experimental technique and the theoretical aspects of the new chemistry. Happily timed from the standpoint of science, his discoveries have enriched chemistry and physics, and revealed a rich and inexhaustible domain which others are developing in Princeton and elsewhere."

THE doctorate of science was conferred at the commencement of Yale University on Dr. Carl Emil Seashore, for thirty years head of the department of psychology at the State University of Iowa. In conferring the degree President Angell said: "Eminent scientist, teacher, administrator: Your long and successful career is a monument to the power of tireless industry when wedded to high intelligence, shrewd ingenuity and sound judgment. From small and feeble beginnings, you have built steadily and without interruption a great scientific edifice which has served humanity well and brought you just renown. Your Alma Mater, in recognition of your signal achievement, confers upon you the degree of doctor of science, admitting you to all its rights and privileges."

DR. A. E. MURNEEK, of the University of Missouri, has been elected *president*; Dr. D. R. Hoagland, University of California, *vice-president*, and Dr. W. F. Loehwing, University of Iowa, *secretary-treasurer*, of the American Society of Plant Physiologists for the year 1935-36.

DR. GEORGE W. GRIER, of Pittsburgh, was elected president of the American Radium Society on June 11 at the Atlantic City meeting.

THE Victorian Branch of the council of the British Medical Association at its meeting on June 5 appointed Lieutenant-Colonel Sir James W. Barrett president-elect for the year 1935-36, to take the place of Sir Richard Stawell, who died on April 18 and who was to have presided over the annual meeting in Melbourne next September. Sir James Barrett is vice-chancellor of Melbourne University and consulting surgeon to the Victoria Eye and Ear Hospital.

DR. OTIS W. CALDWELL, since 1917 professor of education at Teachers College, Columbia University, having reached the age for retirement, has been made professor emeritus. Dr. Caldwell, before going to New York, was professor of botany at the University of Chicago. He was director of Lincoln School, Teachers College, for ten years and later director of the Institute of School Experimentation. His work as general secretary of the American Association for the Advancement of Science and other scientific work will be done from an office in the Boyce Thompson Institute for Plant Research, at Yonkers, N. Y.

DR. JOHN LEIGHTON BRAY, professor of metallurgy at Purdue University, has been appointed head of the School of Chemical Engineering to succeed Professor H. C. Pepper, who died last summer.

NEIL P. BAILEY, professor of mechanical engineering at the Iowa State College, has been appointed head of the department of mechanical engineering at Rutgers University. He succeeds Dr. Robert C. H. Heck, who becomes research professor of mechanical engineering.

DR. HUGH J. MORGAN, professor of clinical medicine, has been elected professor of medicine in the Vanderbilt University School of Medicine, to succeed Dr. C. Sidney Burwell, who was recently elected dean and professor of research medicine at the Harvard University Medical School.

At Princeton University, Dr. Henry DeWolf Smyth, associate professor, has been made chairman of the department of physics to succeed Professor Edwin P. Adams, who has resigned. Dr. William Taylor Thom, Jr., has been promoted to a professorship of geology and Assistant Professor Marcus S. Farr has become associate professor.

PROFESSOR I. M. HEILBRON has been appointed Sir Samuel Hall professor of chemistry and director of the Chemical Laboratories of the University of Manchester in succession to Professor Arthur Lapworth, who has retired. Dr. Colin Campbell, senior lecturer in chemistry, will be assistant director of the laboratories.

DR. ARTHUR J. BALLANTYNE has been appointed to the new chair of ophthalmology, established under the terms of the will of Dr. Gavin Tennant, at the University of Glasgow.

DR. ANDREW TOPPING, of the Public Health Department of the London County Council, has been appointed lecturer in hygiene and public health at Charing Cross Hospital Medical School in succession to the late Dr. C. W. Hutt.

DR. GEORGE FREDERICK HERBERT SMITH, since 1921

secretary of the British Museum (Natural History), has been appointed keeper of mineralogy, to succeed Dr. L. J. Spencer, who will retire on July 7.

DR. HOWARD IRVING COLE, formerly chief chemist of the Philippine Health Service, has been appointed by the League of Nations to conduct research work at the International Leprosy Center recently established at Rio de Janeiro. The new center was founded by the Brazilian Government under the auspices of the League of Nations with the aid of grants from the league, the Brazilian Government and M. Guilherme Guinle, a philanthropist of Rio de Janeiro. The objects of the center are research, instruction and the development of a world-wide cooperation in the campaign against leprosy.

DR. R. RUGGLES GATES, professor of botany at King's College, University of London, plans to spend August and September in Canada and the United States.

DR. CHARLES N. FREY, director of the Fleischmann laboratories, addressed the American Association of Cereal Chemists at Denver on June 7 on "Yeast." The lecture was followed by a moving picture illustrating the manufacture and some of the uses of yeast.

A NEW library and a new chemistry building were dedicated at the University of Arkansas on June 10. The speakers at the library dedication were Senator Joe T. Robinson, Charles T. Coleman, of Little Rock, and Edward J. White, of St. Louis. Dr. Edward Bartow, president-elect of the American Chemical Society, made the chief address, entitled "The House of Chemistry," at the dedication of the chemistry building. Brief addresses were made by alumni and by H. E. Wiedemann, grand master alchemist of Alpha Chi Sigma, chemical fraternity.

APPLICATIONS must be on file not later than July 15 with the U. S. Civil Service Commission at Washington, D. C., for the positions in the Forest Service, Department of Agriculture, of senior technical editor, \$4,600 a year; technical editor, \$3,800 a year, and associate technical editor, \$3,200 a year.

MISS HELEN GREENWOOD, of Worcester, Mass., has presented to the department of botany of Wellesley College her collection of mosses and hepatics numbering one thousand specimens. The collection includes Miss Greenwood's personal collections in Massachusetts, Maine, Nova Scotia, the Canadian Rockies, the Western Coast, and England; and gift and exchange specimens from England, Scotland, France, Sweden and Canada.

THE Belgian Scientific Research Fund presented

on June 12 to the Science Museum, South Kensington, the nacelle of the balloon used by Professors Piccard and Max Cosyns in their second ascent into the stratosphere. Professors Piccard and Cosyns were present and M. Jean Wilhelms, the director of the fund, made the presentation.

TUFTS COLLEGE has completed the construction of a new biological wing of the Barnum Museum. The wing will contain laboratories for histology, embryology, physiology, bacteriology and general biology, as well as offices for the staff. In the entrance hallway has been placed a tablet in memory of Professor Fred Dayton Lambert, who for more than a generation taught biology at Tufts College. The funds for the new wing were left by Phineas T. Barnum.

THE *Philadelphia Inquirer* states that the American Philosophical Society may not accept the bequest of the late William Wood. The residuary estate which the society was to receive was estimated at \$2,000,000 and was to have been used for the erection of a new building. A number of rulings which will affect the amount the society would receive are now under consideration by Judge Charles Klein, of Orphans' Court. Mr. Wood, who was eighty-four and a bachelor, left an estate originally estimated at \$5,000,000. The present accounting shows a balance of \$1,270,571, not including real estate.

A PROGRAM for the expenditure of \$156,298,000 of work-relief funds for forestation in the semi-arid areas of the tree shelter belt zone of the Midwest, as well as in existing foreign preserves, has been advanced by the Forest Service. On May 31 request for the money was made to the Division of Applications in the works program. The forestation program, which would give work in forty-seven states as well as in Alaska, Puerto Rico and the District of Columbia, would be expected to give impetus to the shelter belt project of Dr. Rexford G. Tugwell, Under Secretary of Agriculture. The fund is contemplated for use in a variety of forestry projects. These include such work as the construction and maintenance of fire-

breaks, forest fire lookout houses, towers and observatories, landing fields, telephone lines, forest roads and trails, housing for forest officers, miscellaneous buildings and structures and shelter belt planting.

It is planned to establish, according to the *Journal* of the American Medical Association, in the Rudolf Virchow-Krankenhaus in Berlin a central cancer institute that is to serve all northern Germany. It will be both a therapeutic and a research center. As the first step, a large committee has been appointed, on which, among others, the whole Berlin faculty of medicine will serve, Professor Sauerbruch being the chairman. For this institute, which is to be directed by Professors Cramer and Hintze, a suite of rooms with 300 beds has been selected.

Nature, in reporting the renaming of the Physical Institute of the University of Heidelberg, writes: "The Physical Institute of the University of Heidelberg has recently, in honor of Professor Lenard, been renamed the 'Philipp Lenard-Institut.' A correspondent has sent us a cutting from the students' magazine of that university, giving Professor Lenard's reply to the congratulations of the Heidelberg students on this occasion. The following is a translation of Professor Lenard's reply, and we prefer to make no comment upon it: 'I am very grateful to the students of the University of Heidelberg for their congratulations on the renaming, by the Ministry, of the institute which was built some years ago under my direction. I hope that the institute may stand as a battle flag against the Asiatic Spirit in Science. Our Leader has eliminated this same spirit in politics and national economy—where it is known as Marxism. In natural science, however, with the over-emphasis of Einstein, it still holds sway. We must recognize that it is unworthy of a German—and indeed only harmful to him—to be the intellectual follower of a Jew. Natural science properly so-called is of completely Aryan origin and Germans must to-day also find their own way out into the unknown. Heil, Hitler!'"

DISCUSSION

THE NEW ACTIVE PRINCIPLE OF ERGOT

THE isolation of a new highly important constituent of ergot has recently been announced by Dudley and Moir,¹ and Kharasch and Legault.² Since I³ described

¹ Dudley and Moir, *Brit. Med. Jour.*, March 16, 1935.

² Kharasch and Legault, *SCIENCE*, 81: 388, 1935.

³ Thompson: Doctorate dissertation, Johns Hopkins University, 1934; abstracts published in *Jour. Am. Pharm. Ass'n.*, 21: 853, 1932; 21: 1135, 1932; 22: 736, 1932; 24: 24, 1935; 24: 185, 1935.

the isolation of what is clearly the same substance almost a year before either of these groups of workers, it seems highly desirable that certain facts be presented in order to clarify the rapidly developing confusion and to prevent still more names from being assigned to the same substance.

During the decade preceding 1932, pharmacologists and clinicians accumulated a vast amount of evidence which resulted in what was tantamount to a unanimity

of opinion to the effect that the specific alkaloids ergotoxine and ergotamine were the carriers of the full clinically valuable oxytocic activity of ergot. Consequently, methods of manufacture of and standardization procedures for pharmacopoeial preparations were so selected as to insure the presence of standardized amounts of the specific alkaloidal activity in the finished product,^{4, 5} etc. In June, 1932, Moir⁶ reported the experimental evidence which was responsible for a reopening of the entire ergot problem. Briefly, he clearly demonstrated that the available alkaloids ergotoxine and ergotamine were greatly inferior to crude extracts in their oxytocic activity upon puerperal human patients. Because he obtained prompt and intense activity from aqueous extracts (poor in alkaloids) as well as from hydro-alcoholic extracts (rich in alkaloids), he concluded that the valuable oxytocic activity of ergot resided, not in the specific alkaloids, but in a "new principle as yet unidentified."

Since the publication of a series of ten articles dealing with the pharmacology of ergot in 1929 and 1930, I continued to study the active principles and various extracts on pregnant animals, especially the cat. In August, 1932, approximately two months after Moir's important report appeared, I reported,^{7, 8} similar observations upon the pregnant cat and confirmed his prediction of the existence of a highly important hitherto unidentified principle in ergot by the actual isolation of the substance responsible for the prompt and intense oxytocic activity. The substance had not been obtained in crystalline condition, but was highly active. Contrary to Moir's and Dale's⁹ belief (see also footnotes 10 and 11) this new substance was reported¹² to possess alkaloidal properties. In May, 1934, I reported,^{13, 14} the isolation of the new substance in crystalline form and described its properties, classifying it definitely as a new member of the total specific alkaloids of ergot. I did not assign a name to the new alkaloid up to that time because of the almost simultaneous appearance of Küssner's¹⁵

announcement of the new alkaloid "Ergoclavine." To avoid confusion, I called my principle "X-alkaloid" until I was certain of its identity. A comparative study of the properties of the two new alkaloids soon revealed highly significant differences which set them apart as separate entities. Accordingly, also in May, 1934, I assigned the name "Ergostetrine" to my "X-alkaloid."¹⁶ Ergostetrine shows a number of properties which clearly differentiate it from any previously described alkaloid of ergot, but the one difference of greatest possible importance lies in the fact that its oxytocic activity develops much more promptly and much more intensely than even much larger doses of any one or all of the hitherto known alkaloids, including Sensibamine and Ergoclavine.

In February, 1935, there appeared an article by Davis, Adair, Kharasch and Legault,¹⁷ embracing a report presented at the meeting of the Central Association of Obstetricians and Gynecologists, November 1 to 3, 1934, New Orleans, announcing the isolation of the new powerfully and promptly acting principle. In this report, their experimental evidence dealt with a purified amorphous concentrate which was not chemically identified, but which was stated to be *non-alkaloidal* (in agreement with Moir's and Dale's original belief, but in opposition to my identification of the substance). They called this amorphous impure substance "Ergotocin," although they stated in a footnote that they had recently obtained the substance in crystalline form. No evidence as to its identity was given, except that it was non-alkaloidal because it was obtained from their impure non-alkaloidal "Ergotocin."

On March 16, 1935, Dudley and Moir¹⁸ announced that they had isolated the important oxytocic substance in crystalline form. This constituted the first confirmation of my original identification of the new substance as an alkaloid and, it will be noted, it represents a change from the original view held by the British workers (see footnotes 6, 9, 10, 11). This left only the University of Chicago workers¹⁹ opposed to my identification of the new substance as an alkaloid since Dudley and Moir clearly classified their principle as an alkaloid and named it "Ergometrine."

In February, 1935, Koff²⁰ also concluded that the new substance is alkaloidal in nature, although it should be pointed out that his conclusion was based upon the chemical and pharmacological evidence with which I supplied him, his own work consisting wholly

⁴ Fluid Extract of Ergot, U. S. P., 10th revision.

⁵ Liquid Extract of Ergot, B. P., 1932 edition.

⁶ Moir, *Brit. Med. Jour.*, 1119, June 18, 1932.

⁷ Thompson, *loc. cit.*

⁸ Thompson, report presented at the Toronto meeting of the American Pharmaceutical Association, August 22, 1932.

⁹ Dale, Note appended to Moir's report; see footnote 6.

¹⁰ Lecture on ergot by Barger, with discussion, *Pharm. Jour.*, 597, November 18, 1933.

¹¹ Thompson, *Jour. Am. Pharm. Ass'n.*, 24, footnote on page 189, 1935.

¹² Thompson, *loc. cit.*, note 8.

¹³ Thompson, report presented at the Washington meeting of the American Pharmaceutical Association, May 10, 1934.

¹⁴ Thompson, U. S. Patent Office: Application No. 740,199; submitted May, 1934.

¹⁵ Küssner, *E. Merck's Jahresbericht*, 47: 5, 1934.

¹⁶ See footnote 14.

¹⁷ Davis, Adair, Rogers, Kharasch and Legault, *Am. Jour. Obstet. and Gynecol.*, 29: 155, 1935.

¹⁸ *Loc. cit.*

¹⁹ Davis, Adair, Rogers, Kharasch and Legault, *loc. cit.*

²⁰ Koff, *Surg., Gynecol. and Obstet.*, 60: 190, 1935.

of the clinical experiments, which, incidentally, confirmed the validity of my pharmacological approach. Due credit is accorded me in Dr. Koff's report.

In April, 1935, Kharasch and Legault²¹ reported the isolation of their new principle in a crystalline condition, claiming to have obtained it in December, 1934, and naming it "Ergotocin." This is the name originally used for their impure concentrate. It is of interest to note that my Ergostetrine was isolated and identified exclusively in the laboratory, by chemical and pharmacological methods, whereas Dudley's and Moir's Ergometrine and Kharasch's and Legault's Ergotocin were subsequently but independently obtained with the aid of numerous clinical observations upon puerperal humans. The validity of the results obtained by my pharmacological methods was, of course, confirmed by clinical experiments conducted by Dr. Koff and others.

While there is yet much to be done in studying the properties of the new principle, it is believed that the already existing evidence conclusively shows that my Ergostetrine, Dudley's and Moir's Ergometrine and Kharasch's and Legault's Ergotocin are one and the same substance, and that this substance is unquestionably an alkaloid. It is unfortunate that delays in publication have resulted in the confusion already existing. My Ergostetrine was identified as an alkaloid which melts and decomposes at 154 to 155.5 degrees Centigrade, and whose 0.1 per cent. solution in chloroform is laevo-rotatory to the extent of approximately 50 degrees.^{22, 23} Dudley and Moir²⁴ reported their Ergometrine to melt and decompose at 150-152 degrees Centigrade, and the optical activity of a 0.1 per cent. solution in chloroform to be 45 degrees laevo-rotatory. Kharasch and Legault²⁵ state that their Ergotocin (non-alkaloidal?) melts and decomposes at 155 degrees Centigrade, and although they fail to give specific rotation, they state that crystalline Ergotocin "as so far obtained, is dextro-rotatory." In support of my contention that Ergostetrine, Ergometrine and Ergotocin are one and the same substance, it will be noted that my decomposition point is in agreement with that of Kharasch and Legault, but that the optical activity of my Ergostetrine differs from the claim of the same workers. On the other hand, it will be noted that the optical activity of my Ergostetrine is in reasonable agreement with that reported by Dudley and Moir for their Ergometrine, while their decomposition point is definitely lower than for my Ergo-

stetrine. In explanation of these differences, it should be noted that Dudley and Moir admit the possible slight impurity of their crystalline Ergometrine, thus accounting for the slight difference in our respective observations on optical activity and decomposition point. The decomposition point of my crystalline Ergostetrine agrees excellently with that reported by Kharasch and Legault for their Ergotocin. This leaves the only important point of difference among the three named substances to be that Kharasch and Legault report their substance dextro-rotatory, while Dudley and Moir and I agree that the substance is laevo-rotatory. In connection with the latter point which might indicate that the principle isolated by Kharasch and Legault differs from that isolated by myself and that of the British workers, I would point out that through the courtesy of Eli Lilly and Company, I have had the opportunity of examining crystalline Ergotocin. Under identical conditions, crystalline Ergotocin and crystalline Ergostetrine were found to be identical as to decomposition point, optical activity and oxytocic activity on pregnant cats, all data being in agreement with that assigned by me for Ergostetrine.^{26, 27} I consider it a virtual certainty that, as increased amounts of the material become available, others will confirm my contention that the three names have been independently assigned to the same substance.

In April, 1935, I read a paper²⁸ summarizing the pertinent literature and describing the chemical and pharmacologic properties of my alkaloid "Ergostetrine," emphasizing its laevo-rotation (-45 to -50 degrees) in chloroform solution, its decomposition point (154 to 155.5 degrees Centigrade), the fact that it crystallizes readily from chloroform and benzol, less readily from ether, that it gives a strong Cocksecomb reaction, and Smith Color reaction, and that it occurs in different lots of ergot to the extent of 0.05 to 0.2 mg per gm. Clinical studies on over 350 puerperal human patients by Dr. Vernon Tuck, of the Philadelphia General Hospital, have been completed and will be reported in due course, the Ergostetrine having been given orally, rectally and intramuscularly. The human dosage is in agreement with that reported by Dudley and Moir and the University of Chicago workers.

Just prior to sending this note to press, a discussion by the British workers in the June 7 issue of SCIENCE came to my attention. With the information at their disposal, I am impressed with their accuracy and fairness, in the treatment of the controversial points. They are laboring under a wrong impression, however,

²¹ *Loc. cit.*

²² See footnote 14.

²³ Thompson, report presented at the Detroit meeting of the American Society for Pharmacology and Experimental Therapeutics, April, 1935.

²⁴ *Loc. cit.*

²⁵ *Loc. cit.*

²⁶ See footnote 14.

²⁷ See footnote 23.

²⁸ *Ibid.*

regarding several phases. Referring to the footnote in my article which appeared in March, 1935, they state that "Thompson reports a later success in crystallizing what was very probably our Ergometrine." That the three independently obtained substances are identical is now established, but I would emphasize that my footnote did not refer to a "later success." This same footnote is contained in the bound copy of my doctorate dissertation, which was accepted by the Johns Hopkins University prior to May 1, 1934, and it constituted a part of my March, 1935, article at the time it was submitted for publication in the *Journal of the American Pharmaceutical Association* on May 10, 1934, more than nine months prior to the announcement of crystalline Ergometrine by Dudley and Moir or the subsequent announcement of crystalline Ergotocin by Kharasch and Legault.

I would add my support to the suggestion by our British colleagues that a single scientific name be decided upon for this new important alkaloid, but unfortunately my name "Ergostetrine" is not a mere matter of "note-book record." This name was both scientifically and legally assigned²⁹ by me in May, 1934. I would emphasize the importance of a universal agreement establishing a single place of registration for new names assigned to complex new plant or animal constituents, without the necessity of patent application to establish a point on a definite date.

MARVIN R. THOMPSON

SCHOOL OF PHARMACY
UNIVERSITY OF MARYLAND

THE CROSS-INOCULATION OF BACTERIAL-PLANT GROUP OF CICER

THE isolation of pure cultures of the root nodule bacteria, cross inoculation and strain efficiency studies on *Cicer arietinum* L. and other species of Indian leguminous crops were conducted by the writer at the University of Wisconsin during 1931-33. It was found that the root nodule bacteria of *Cicer arietinum* L. are specific for that host plant and may be considered a separate group not belonging to the pea group as stated by Simon.¹ A preliminary mention of this finding appeared as a footnote in the monograph of Fred, *et al.*,² and the detailed paper has recently been submitted to the *Indian Journal of Agricultural Science*.

Rasumowskaja³ has recently reported on the specificity of *Cicer arietinum* L. for nodule production and

states that it does not belong to the pea-group. This author does not appear to have noticed the previous mention of this by Fred, *et al.*² His work was confined to inoculation of *Cicer arietinum* with the crushed nodules of *Vicia sativa*, *Vicia cracca* and *Pisum sativum* and pure cultures of nodule bacteria of pea and vetch only, whereas the present writer's conclusions have been based upon studies on cross-inoculations with pure cultures of all the known bacterial-plant groups.

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VITAMINS?

IN the early days of vitamin research, classification by alphabetic order was accepted as a temporary convenience. Indirectly this lettering of unknown, quasi-mysterious substances did much to popularize them and to make the world vitamin-conscious.

The crystallization, the isolation and our more or less definite knowledge of the physiological properties of the so-called vitamins show that there is no longer any scientific basis to maintain such widely different chemical substances as carotenes, ascorbic acid, irradiated sterols, pyrimidine-thiazole compounds, sodium phosphate, manganese compounds, etc., under the same heading, except perhaps for historical purposes.

The academical disagreement between British and American biologists over mere initials to be given to otherwise well-defined products adds to the confusion.

Anti-neuritic, anti-scorbutic, anti-rachitic, anti-anemic, anti-goitric, etc., substances should be classified with the chemical family to which they belong or grouped with the natural or pharmaceutical substances which have closely related physiological properties.

The vague expression "vitamin" will eventually join the musty company of phlogistic, humors, animalcules and kindred antiquated terms.

ANDREW MOLDAVAN

CYTOGENETIC NOTES ON SPHAERALCEA AND MALVASTRUM

No chromosome numbers in the genus *Sphaeralcea* have been recorded previously. The only chromosome number reported for a closely related genus is that of 21 pairs in *Malvastrum capense* Gray and Harvey.¹

Recently the chromosome numbers of approximately 15 species, 20 subspecies and 2 botanical forms of the subgenus *Eusphaeralcea* from the southwestern United States have been determined. The basal chromosome number for the subgenus is 5. The prevailing numbers are 5 and 10 pairs, but 15 pairs are of frequent occurrence. Only one form with 25

¹ A. H. S. Stenar, *Akad. Abhand. Upsala*, 1-75, 1925.

²⁹ See footnote 14.

¹ J. Simon, *Centbl. Bakt. (etc.)*, 2 Abt. 41: 470-479, 1914.

² E. B. Fred *et al.*, University of Wisconsin Studies in Science, No. 5, footnote on p. 127, 1932.

³ S. G. Rasumowskaja, *Centbl. Bakt. (etc.)*, 2 Abt. 90: 330-335, 1934.

pairs has been encountered, and none, so far, with 20 pairs. Among approximately 275 plants examined, 12 were apparently natural hybrids. During meiosis these plants exhibited chromosome behavior typical of hybrids.

Of forms usually referred to *Sphaeralcea* but not belonging to the subgenus *Eusphaeralcea*, the writer finds that *S. rivularis* (Doug.) Torrey has 33 pairs of chromosomes and that *S. umbellata* (Cav.) Don and *S. abutiloides* (L.) Don, have 17 pairs. Six species and 2 subspecies of the related genus *Malvastrum* (subgenus *Malacothamnus*) were found to have 17 pairs of chromosomes.

The subgenus *Eusphaeralcea* is unique in that it presents the lowest basal chromosome number and the first highly polyploid group detected in the Malvaceae. In view of the occurrence of several 5-paired species, Davie's suggestion² that 7 is the ancestral basic number for this family can hardly be accepted.

The chromosome number of the California species of *Malvastrum* (the genus *Malacothamnus* of Greene) clearly separates this group from *Sphaeralcea*. The chromosome numbers, considered in relation to the morphological evidence,³ indicate that Greene's genus *Iliamna*, represented by *S. rivularis*, Zuccarini's genus *Meliphlea*, represented by *S. umbellata*, and Desvaux's genus *Phymosia*, represented by *S. abutiloides*, may be well founded.

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SCIENTIFIC MEN AND THE NEWSPAPERS

I LEARN from a letter which my friend Howard W. Blakeslee, of the Associated Press, publishes in *SCIENCE* for June 14, 1935 (p. 591) that scientists should "speak the language of the newspapers" and that they should be more emotional. This implies that newspapers are thoroughly satisfactory in their methods of appeal.

A community gets exactly the kind of a newspaper

that it can digest—no better, no worse. Editors are aware of this and present the news accordingly. If their readers all wore Phi Beta Kappa keys they would remold their policies.

I see no particular reason why the scientist should become emotional and talk in the vulgate because the newspapers will then give his utterances more space.

It is the business of the journalist and not of the scientist to present the discoveries of the laboratory so that the many will understand. But heaven forbid that the popularizer should rely too much on emotion. We have passed the stage when gasping wonder can pass for popularization. We need more journalists trained in science and not more scientists with a flair for popular writing.

Since newspapers are published to meet the needs of the people by men who know their business it follows that it is the school and the college that are at fault. If we had a public adequately educated in science it would not be necessary to explain the meaning of elementary technical terms and principles or to resort to the literary devices of the primary school reader to drive home the facts about a new discovery. The question that Mr. Blakeslee raises is one that must be solved not by laboratory workers or newspaper editors but by the faculties of our colleges and universities. To think that at this late day it is possible to print in only one American newspaper the simple equation that expresses the mass-energy relation of Einstein in a popular article on atomic physics with the realization that it will be understood by enough readers! If an educated Greek in the time of Pericles could discuss geometry at the dinner table it must have been because science was taught as a cultural subject. Give us high-school and college graduates with a broad knowledge of science and the newspapers will respond to their demands rapidly enough.

WALDEMAR KAEMPFERT,

Science Editor, *The New York Times*

SCIENTIFIC BOOKS

QUANTUM MECHANICS

Principles of Quantum Mechanics. By P. A. M. DIRAC. Second Edition. Oxford, Clarendon Press. 1935. xi+300 pp. \$6.00.

THE first edition of this book (1930) contained an absolutely reliable and authentic account of the foundations of quantum dynamics, its main methods and results. Naturally, it soon became an indispensable

aid both to independent workers in this field and to advanced students preparing for independent work. The systematic use of the symbolic transformation theory, largely developed by Dirac himself, made the presentation in the larger part of the book concise, elegant and simple. It had, however, one serious drawback: the highly abstract character of the introductory chapters. In the first place, the notion of observables (see below) was introduced in a manner so detached from experiment that the reader may have remained unconvinced that their measurement is in all cases possible. In the second place, a rather

² J. H. Davie, *Jour. Genetics*, 28: 33-67, 1933.

³ T. H. Kearney, *Univ. Calif. Publ. Bot.*, 19: No. 1, in press.

unusual meaning was assigned to the term "state." Having in mind the indeterminacies of atomic systems, the author aimed by this word at a characteristic which is at once but little affected by the uncertainties and is permanent in time (something like a generalization of the "stationary states"). It must be admitted that such a concept is fundamental, and attractive as a basis of quantum mechanics. But to use for it the word "state" is conducive to constant misunderstandings. It was mainly due to these two features that the first part of the old edition made difficult reading, overtaxing the powers of abstraction of the less experienced student and making the book unsuitable as a classroom text.

Both flaws are completely eliminated from the second edition. The author does not forget for a moment to stress the experimental point of view and lives up in his exposition to the principle stated by him on page 5: "Only questions about the results of experiments have real significance and it is only such questions that theoretical physicists consider." The text is rewritten with a view of attributing to the word "state" its more common sense as the quantum analogue to the numerical values, at a given moment, of the coordinates and momenta of a classical dynamical system. (While an "observable" is the analogue to the instantaneous numerical value of a classical variable or of a function of the coordinates and momenta). This meaning of the word "state" may be less fundamental for the quantum theory than that used in the first edition, but its didactic superiority is unquestionable. It manifests itself in the fact that its use quite naturally divides the treatment into two parts—"part (I), dealing with relations and laws of nature governing the state of affairs in an atomic system at one instant of time, and part (II), dealing with the connexion between the state of affairs at one instant of time and at a slightly later instant." The content of the first part (Chapters II to V) is, from the mathematical point of view, the symbolic algebra of transformations and, from the physical, the statement of the limitations of our power of observation of small systems. The second part (Chapters VI to XIII) is, in both respects, the analogue of the equations of motion of classical mechanics and contains all the special applications.

This change in the direction of making the exposition less abstract does not sacrifice, but rather enhances, its logical rigor and mathematical elegance. It makes the book clear and simple in all its parts, and there is no longer any reason why it should not prove of excellent service as a text in advanced courses. In fact, the author's ability "to keep the physics to the forefront" is an important pedagogical advantage. Paradoxically, it takes a great master of

mathematics to give a truly physical presentation, and the formalism developed by Dirac is particularly adapted to keep the mathematical apparatus ancillary to the physical content.

The subject-matter is not materially changed in the new edition. One of the most important events, since the appearance of the old one, was the discovery of the positron. It was a triumph of Dirac's theory of the electron because it supplied a physical interpretation of the negative energy states. Questions relating to the formation of electron-positron pairs are in the foreground of current theoretical investigations. The author must have felt, however, that these theories have not yet crystallized into a consistent system and are not secure enough to be included in a treatise of the character of a text- and hand-book: only one brief section is devoted to the positron. On the other hand, there is attached to it a new chapter on the electromagnetic field theory which has attained in the last years a formally satisfactory character as a complete analogue to classical electrodynamics (although some deeper problems connected with the structure of the electron remain unresolved). A valuable new feature is an "Index of Definitions," which was lacking in the first edition.

PAUL S. EPSTEIN

GARDEN PLANTS

The Genetics of Garden Plants. By M. CRANE and W. J. C. LAWRENCE. Foreword by Sir Daniel Hall. Pp. xxi, 236. 53 figures, 42 tables. Macmillan and Company, London, 1934. 10s. 6d.

THE authors state in their preface that the object of this book is twofold: first, to give an introduction to the essential principles of genetics and cytology; and secondly, to give an account of recent results in relation to horticulture.

The first three chapters are devoted to a brief treatment of the genetics and cytology of diploid and polyploid plants. The next chapter deals with flowering and ornamental plants. Limitations of space preclude a discussion of all the work which has been done, so the authors confine their attention chiefly to those plants which have been most intensively investigated. The sweet pea, garden stock, Chinese primrose, dahlia and snapdragon are considered and the chapter closes with brief comment on a number of interspecific hybrids. The present reviewer would have welcomed a more detailed account of the work which Baur and his associates have carried on with *Antirrhinum*, but obviously in a general text covering such a wide field it is impossible to discuss any particular plant at great length.

The tomato, garden pea, radish, lettuce, onion, beet, cucumber and potato are among the vegetable and salad plants discussed. A long list of fruits is dealt

with, but even so a considerable number, including the citrus fruits, have been omitted. In the opinion of this reviewer the value of the book would have been considerably enhanced if it had been restricted in scope to the flowering and ornamental plants, or the vegetable and salad plants, or the fruits, thus permitting a more comprehensive review of a relatively limited field.

The chapters dealing with incompatibility and sterility are of great interest to both the geneticist and practical plant breeder. They show clearly the important progress which has been made in this field in recent years.

The final chapter outlines the modes of origin of

new and improved forms of garden plants. A number of interesting cases of constant hybrids are given. Among other problems brief mention of breeding for disease resistance is included. This subject is receiving increasing attention and represents one of the most promising fields open to the plant breeder at the present time, so it might well have been given greater emphasis.

The book includes a glossary, bibliography and index. It is written in a clear and interesting way, and will doubtless be favorably received by both geneticists and plant breeders.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

SAND AND WATER PARADOX

At the March meeting of the Central Ohio Physics Club, Dr. G. E. Owen presented a startling experiment which apparently has not been completely explained. The apparatus consisted of a rubber bulb about 50 cc capacity with a glass tube, in which one could observe the water level at about half the length of the tube. When the bulb was squeezed, instead of an expected rise in level, the water was rapidly drawn into the bulb!

If the position of the level in the tube is to be considered as the indication of the pressure within the rubber bulb, then we have an interesting working model for that hypothetical part of van der Waals' equation where, indeed, a decrease in volume causes also a decrease in pressure.

The construction of the apparatus is made clear in Fig. 1, a, in its vertical cross section. The rubber bulb is tightly packed with sand up to the lower end of the

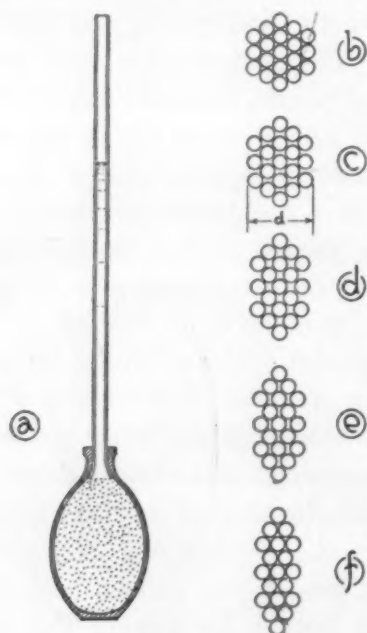


FIG. 1.

glass tube, which is flared. A silk bolting cloth is stretched across the mouth of the tube to prevent sand from entering into the tube. Under ordinary conditions the grains of sand are so packed as to occupy the state of lowest potential energy which leaves the least volume between them. When the bulb is compressed, the spheres separate and the increased interstices draw in the water from the vertical tube. In a two-dimensional idealized diagram, Fig. 1, b, the

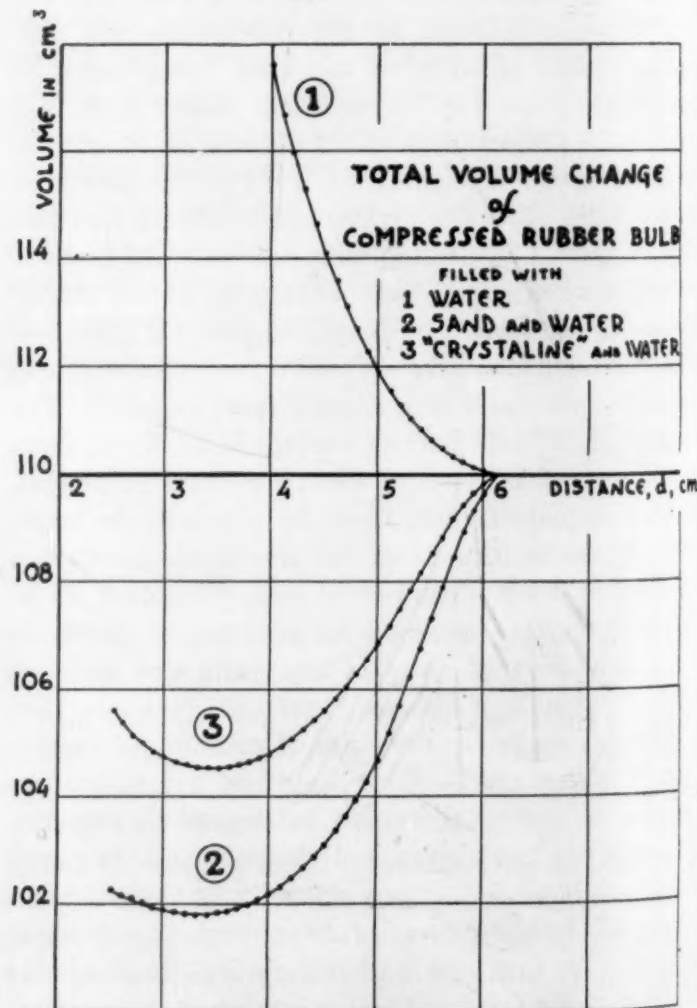


FIG. 2.

circles of equal diameters represent their original positions. The area between the circles will reach a maximum when the circles are rearranged, as in d; on further compression the area will start to decrease, shown in e, returning finally to its original value, as in f, equal to that of b.

To verify the above explanation an experimental set-up was made with a 100 cc rubber bulb between the parallel jaws of a milling machine vise. The height of the water level was measured by means of a meter stick arranged parallel to the vertical tubing. The tube was calibrated by measuring the volume of water that filled a certain length of the tube. The distance *d*, between the jaws, was determined from the pitch of the screw. The data are presented in form of three curves in Fig. 2. Curve 1 was obtained for a bulb filled with water only. Curve 2 shows how the water level changes with the distance *d*, when the bulb is tightly packed with the sand. In Curve 3, the bulb was filled with small glass spheres, ranging from .0215" to .0224" in diameter. These small spheres are produced by atomizing molten glass and are

solidified in the air. Surface tension is responsible for their perfect sphericity. They are used for decorative purposes under the name of "Crystalline" or "Glascherben." These curves definitely show the minimum volume for water and sand or glass spheres and an increase in volume on further decrease in *d*. As was expected, for the same change in *d*, the minimum is more pronounced with the glass spheres. Because of larger frictional forces between the irregular grains of sand the interspacial volume for sand increases more rapidly and reaches larger value than in the case of glass spheres. The limit of compression was set by the strength of the rubber bulb.

The phenomenon described here is a familiar experience to those at the seashore who have noticed how rapidly the water "dries up" around foot prints when walking on the wet sand.

Any of the readers who can give the reference to any publications concerning the described effect are kindly asked to communicate with the author.

ISAY A. BALINKIN

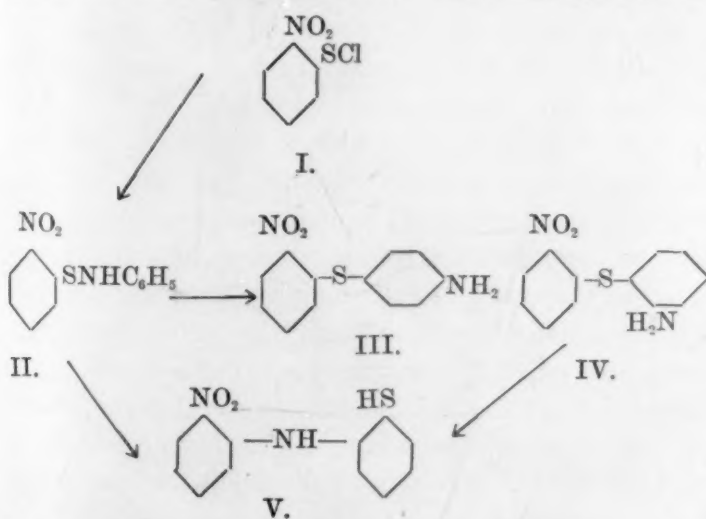
UNIVERSITY OF CINCINNATI

SPECIAL ARTICLES

MOLECULAR REARRANGEMENTS OF SULFANILIDES

DURING recent work in this laboratory on the development of improved methods for the synthesis of new sulphide phenol compounds possessing high antiseptic and germicidal power, it was discovered that certain sulphur compounds of the sulfanilide type are capable of undergoing profound molecular changes. Two types of transformations have thus far been revealed in the course of our researches, which may be illustrated by the following example: The starting point serving for our illustration is *o*-nitrophenylsul-

good yield *o*-nitrophenylsulfanilide II. We find that this latter compound II undergoes two types of molecular change, depending upon the experimental conditions employed. (1) If the sulfanilide II is heated at a definite temperature, or if it is digested with its respective amine (aniline) at its boiling point, it is transformed into its isomeric 2-nitro-4'-aminodiphenylsulphide III. In some cases we have also observed a corresponding *ortho* rearrangement IV. (2) On the other hand, when the sulfanilide II is warmed in alcohol in the presence of sodium hydroxide it undergoes an entirely different type of change and is transformed smoothly into a mercapto-diphenylamine derivative corresponding to formula V. Regarding the mechanism of this last change we are not prepared to offer a decisive explanation. The simplest postulation, that we are dealing here with the intermediate formation of an *ortho*-aminosulphide (formula IV), which then rearranges to the isomeric diphenylamine V, does not satisfy as the correct explanation. The English chemist, Dr. Smiles, and his co-workers report¹ that *o*-aminosulphides of this type, studied by them, are unattacked by alcoholic sodium hydroxide, while the corresponding acetyl- and benzoyl-derivatives, for example, rearrange easily to diphenylamine derivatives under the same experimental conditions. Two types of reaction products, therefore, are possible of



furchloride I, which is easily prepared by the action of chlorine on *o*-nitrophenyldisulphide. This sulfur-chloride I interacts smoothly with aniline to form in

¹ See Evans and Smiles, *Jour. Chem. Soc. (London)*, p. 183, 1935.

formation by molecular rearrangement of a given sulfanilide. We are interested in determining the structural configurations limiting the practical application of this double molecular rearrangement.

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ISOLATION OF A CRYSTALLINE PROTEIN POSSESSING THE PROPERTIES OF TOBACCO-MOSAIC VIRUS

A CRYSTALLINE material, which has the properties of tobacco-mosaic virus, has been isolated from the juice of Turkish tobacco plants infected with this virus. The crystalline material contains 20 per cent. nitrogen and 1 per cent. ash, and a solution containing 1 milligram per cubic centimeter gives a positive test with Millon's, biuret, xanthoproteic, glyoxylic acid and Folin's tyrosine reagents. The Molisch and Fehlings tests are negative, even with concentrated solutions. The material is precipitated by 0.4 saturated ammonium sulfate, by saturated magnesium sulfate, or by safranine, ethyl alcohol, acetone, trichloroacetic acid, tannic acid, phosphotungstic acid and lead acetate. The crystalline protein is practically insoluble in water and is soluble in dilute acid, alkali or salt solutions. Solutions containing from 0.1 per cent. to 2 per cent. of the protein are opalescent. They are fairly clear between pH 6 and 11 and between pH 1 and 4, and take on a dense whitish appearance between pH 4 and 6.

The infectivity, chemical composition and optical rotation of the crystalline protein were unchanged after 10 successive crystallizations. In a fractional crystallization experiment the activity of the first small portion of crystals to come out of solution was the same as the activity of the mother liquor. When solutions are made more alkaline than about pH 11.8 the opalescence disappears and they become clear. Such solutions are devoid of activity and it was shown by solubility tests that the protein had been denatured. The material is also denatured and its activity lost when solutions are made more acid than about pH 1. It is completely coagulated and the activity lost on heating to 94° C. Preliminary experiments, in which the amorphous form of the protein was partially digested with pepsin, or partially coagulated by heat, indicate that the loss in activity is about proportional to the loss of native protein. The molecular weight of the protein, as determined by two preliminary experiments on osmotic pressure and diffusion, is of the order of a few millions. That the molecule is quite large is also indicated by the fact that the protein is held back by collodion filters through which proteins such as egg

albumin readily pass. Collodion filters which fail to allow the protein to pass also fail to allow the active agent to pass. The material readily passes a Berkefeld "W" filter.

The crystals are over 100 times more active than the suspension made by grinding up diseased Turkish tobacco leaves, and about 1,000 times more active than the twice-frozen juice from diseased plants. One cubic centimeter of a 1 to 1,000,000,000 dilution of the crystals has usually proved infectious. The disease produced by this, as well as more concentrated solutions, has proved to be typical tobacco mosaic. Activity measurements were made by comparing the number of lesions produced on one half of the leaves of plants of Early Golden Cluster bean, *Nicotiana glutinosa* L., or *N. langsdorffii* Schrank after inoculation with dilutions of a solution of the crystals, with the number of lesions produced on the other halves of the same leaves after inoculation with dilutions of a virus preparation used for comparison.

The sera of animals injected with tobacco-mosaic virus give a precipitate when mixed with a solution of the crystals diluted as high as 1 part in 100,000. The sera of animals injected with juice from healthy tobacco plants give no precipitate when mixed with a solution of the crystals. Injection of solutions of the crystals into animals causes the production of a precipitin that is active for solutions of the crystals and juice of plants containing tobacco-mosaic virus but that is inactive for juice of normal plants.

The material herein described is quite different from the active crystalline material mentioned by Vinson and Petre¹ and by Barton-Wright and McBain,² which consisted, as Caldwell³ has demonstrated, largely of inorganic matter having no connection with the activity. These preparations were less active than ordinary juice from diseased plants, and the activity they possessed diminished on further crystallizations.

The crystalline protein described in this paper was prepared from the juice of Turkish tobacco plants infected with tobacco-mosaic virus. The juice was brought to 0.4 saturation with ammonium sulfate and the precipitated globulin fraction thus obtained was removed by filtration. The dark brown globulin portion was repeatedly fractionated with ammonium sulfate and then most of the remaining color was removed by precipitation with a small amount of lead subacetate at pH 8.7. An inactive protein fraction was removed from the light yellow colored filtrate by adjusting to pH 4.5 and adding 2 per cent. by weight of standard celite. The celite was removed, suspended in

¹ C. G. Vinson and A. W. Petre, *Contrib. Boyce Thompson Inst.*, 3: 131, 1931.

² E. Barton-Wright and A. McBain, *Nature*, 132: 1003, 1933.

³ J. Caldwell, *Nature*, 133: 177, 1934.

water at pH 8, and the suspension filtered. The active protein was found in the colorless filtrate. This procedure was repeated twice in order to remove completely the inactive protein. Crystallization was accomplished by adding slowly, with stirring, a solution containing 1 cubic centimeter of glacial acetic acid in 20 cubic centimeters of 0.5 saturated ammonium sulfate to a solution of the protein containing sufficient ammonium sulfate to cause a faint turbidity. Small needles about 0.03 millimeters long appeared immediately and crystallization was completed in an hour. Crystallization may also be caused by the addition of a little saturated ammonium or magnesium sulfate to a solution of the protein in 0.001 N acid. Several attempts to obtain crystals by dialyzing solutions of the protein gave only amorphous material. To date a little more than 10 grams of the active crystalline protein have been obtained.

Although it is difficult, if not impossible, to obtain conclusive positive proof of the purity of a protein, there is strong evidence that the crystalline protein herein described is either pure or is a solid solution of proteins. As yet no evidence for the existence of a mixture of active and inactive material in the crystals has been obtained. Tobacco-mosaic virus is regarded as an autocatalytic protein which, for the present, may be assumed to require the presence of living cells for multiplication.

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ACTION POTENTIALS DURING HIGH AND LOW FREQUENCY STIMULATION OF MEDULLATED NERVE

It has been shown by Hill and his collaborators (Feng and Hill,¹ Bugnard,² Hill,³ Bugnard and Hill⁴) that when the frequency of a stimulus applied to frog medullated nerve is increased above about 500 shocks per second at room temperature there is a falling off in the total response as measured either by the heat produced or the accompanying electric potential. At a frequency of 2,500 one-way or 5,000 two-way shocks per second the response is only about 10 per cent. of that at the optimal frequency. Recently Cattell and Gerard⁵ made the observation that a high frequency stimulus, itself producing a very small response, does not prevent the nerve from responding to a stimulus

of lower frequency, applied above, at or below the electrodes giving the high frequency stimulation. These results indicated that the decreased effectiveness of high-frequency excitation involves a local change occurring at the stimulating electrodes. In the light of these observations Bugnard and Hill⁶ have made a further analysis of the problem, interpreting the results on the basis of refractory period, summation and post-excitatory changes in irritability. All the experiments mentioned above were carried out with a technique which measured only the total response over a period of time and have the drawback that they do not permit observations of the individual action potentials in relation to the various combinations of stimulation frequencies, a deficiency which has had to be supplied by inference. We have therefore made a series of similar experiments, recording the details of the potential picture on the cathode-ray oscillograph. Individual responses were then directly observed under different experimental conditions with the following results.

1. *The effect of increasing shock frequency.* As the stimulation rate is progressively increased successive supermaximal shocks fall within the refractory period of the preceding responses and the individual action potentials therefore become smaller. Then there follows the well-known alternation in magnitude, and finally, with frequencies above 1,000 per second, only small irregular responses occur. This last state is the potential picture of the phenomenon originally described as "inhibition" by Bugnard. If the intensity of the stimulus is increased greater responses can be obtained.

2. *The ability of the rapidly stimulated or "inhibited" nerve to conduct superimposed impulses.* If, against a background of high frequency stimulation, extra stimuli of the same or lower intensity are applied through different electrodes, there are produced responses to these extra stimuli which are transmitted through the region of high frequency stimulation, as was observed by Cattell and Gerard. These responses can be reduced in magnitude by increasing sufficiently the intensity of the background stimulation; an effect which is presumably due to increased background activity, as described in the preceding paragraph.

3. *The ability of the nerve to respond to superimposed stimuli.* Not only can the "inhibited" nerve be stimulated at electrodes other than those carrying the high frequency background, but extra stimuli applied through the same electrodes are also capable of producing a response. (Indeed, in this case a curious phenomenon has been regularly observed: following the response to the extra stimulus there is an increased

⁶ L. Bugnard and A. V. Hill, *Jour. Physiol.*, 83: 416, 1935.

¹ T. P. Feng and A. V. Hill, *Proc. Roy. Soc. B*, 113: 366, 1933.

² L. Bugnard, *Jour. Physiol.*, 80: 441, 1934.

³ A. V. Hill, *Suppl. SCIENCE*, Vol. 79, 9, 1934.

⁴ L. Bugnard and A. V. Hill, *Jour. Physiol.*, 83: 383; 394, 1935.

⁵ McK. Cattell and R. W. Gerard, *Jour. Physiol.*, 83: 407, 1935.

responsiveness to the background stimuli. This increase has been seen to last as long as 50 milliseconds.)

The extra stimulus can be applied in either of two ways: (a) electrically in the same direction as the background stimulation or (b) in the opposite direction. Under both conditions a response can be produced. In the first case the response varies in height as the extra stimulus varies in its time relations with respect to the stimuli of the high frequency background. This indicates that the response is dependent upon the summation of stimuli and accords with the observations of Bugnard and Hill.⁶ When the two sets of stimuli are opposed in direction a full-sized response is produced with great regularity. Obviously summation of stimuli plays no part here, and the probable factors concerned will be discussed below.

DISCUSSION

We can, therefore, present the following potential picture which describes the decreased effectiveness of stimuli applied at rates on the order of 2,500 per second: (1) The response to these high rates of stimulation is largely but not completely abolished. (2) This decreased response is partly due to a decreased excitability at the stimulating electrodes, since the response can be increased by raising the strength of the high frequency stimuli or by summing an extra shock with the background excitation. (3) The decreased excitability which obtains at the high frequency electrodes is not present elsewhere on the nerve, since extra stimuli of normal strength applied through other electrodes can produce practically full-sized responses. Furthermore, the decreased excitability at the high frequency electrodes is localized in the region of the cathode, since an extra just supermaximal shock applied at the electrodes carrying the high frequency stimulus, but reversed in electrical sense, produces almost a full response.

From the foregoing picture the decreased effectiveness of high rates of stimulation can be explained on the basis of two factors: refractoriness and cathodal depression, as suggested by Bugnard and Hill.⁶ At any one time most of the fibers are refractory to successive stimuli of the series. The ineffective stimuli, therefore, produce a cathodal depression such as was described by Gildemeister⁷ and by Erlanger and Blair.⁸ Our observations are in accord with the conclusions of Bugnard and Hill⁶ (p. 424) that "shocks which are 'ineffective' owing to falling in the refractory period, nevertheless depress the excitability and extend the

refractory state,"⁹ and also that extra shocks applied through the same electrodes and in the same sense electrically are effective only when they summate with background stimuli. Bugnard and Hill, however, conclude that an extra shock "in the opposite electrical sense, raises the excitability and shortens the refractory state" (p. 424) and postulate that such a shock does not itself excite but enables the next following background stimulus to become effective. Although such a condition may exist in alternating high frequency stimulation, it does not occur when an extra reversed shock is applied against a background of unidirectional stimulation as in the present experiments. Oscillograph records of the time relations show, on the contrary, that the large response following the extra stimulus is produced by the latter and not by the succeeding background stimulus. We have furthermore tested, both at the anode and at the cathode, the excitability of the nerve immediately after 30 or more seconds of high frequency stimulation. At the cathode the response to a maximal testing shock does not reach full height until after 10 to 12 seconds, while at the anode there has been almost no change in excitability and the response to the testing shock is nearly maximal immediately after the background stimulation is removed. We therefore conclude that with high rates of stimulation the local depression is confined to the region of the cathode, so that an extra reversed stimulus is effective because the anodal region is not significantly depressed.

SUMMARY

Observations of individual action potentials during high frequency stimulation show that the failure to excite, in so far as it is not due to refractoriness, depends upon a localized depression at the cathode which may last for a considerable period after the stimulation has been discontinued. Excitability of all other regions of the nerve, including that at the high frequency anode, is not significantly altered.

McKEEN CATTELL

HARRY GRUNDFEST

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⁹ Bugnard and Hill use the term "refractory state" for a local decrease in excitability owing to a combination of the effects of refractory period and local excitatory change.

BOOKS RECEIVED

- FINGER, CHARLES J. *The Distant Prize: The Opening and Settlement of North America*. Pp. ix + 330. Appleton-Century. \$2.50.
MUNZ, PHILIP A. *A Manual of Southern California Botany*. Pp. xxxviii + 542. 310 figures. J. W. Stacey, Inc., San Francisco. \$5.00.
YATES, RAYMOND F. *The Art of Inventing*. Pp. xiii + 284. 68 figures and plates. Appleton-Century. \$3.00.

⁷ M. Gildemeister, *Pflüger's Arch.*, 124: 447, 1908.

⁸ J. Erlanger and E. A. Blair, *Am. Jour. Physiol.*, 99: 108, 1931.

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SCIENCE NEWS

Science Service, Washington, D. C.

SOME ADVANCES IN THE SCIENCES
DURING 1934

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Medicine

A SERUM, believed to be the first, that counteracts the effect of the often fatal bite of the black widow spider was perfected by Dr. Fred D'Amour, University of Denver professor.

New knowledge of how pancreatic enzymes of ferments become active was obtained with the extraction of a new and potent protein-digesting enzyme, chymotrypsin, and a new protein, chymo-trypsinogen, by Drs. M. Kunitz and J. H. Northrop, Rockefeller Institute laboratories at Princeton, N. J.

The outbreak of amebic dysentery, starting in Chicago during the fall of 1933, was found by the Chicago City Health Department to be caused by sewage contamination of the water supply of two Chicago hotels.

The cysts which transmit amebic dysentery can be filtered out of water by the usual filtration methods used to purify water supplies, Dr. Bertha Kaplan Spector, U. S. Public Health Service, and John R. Bayliss and Oscar Guillins, chemists of the Chicago Department of Public Works, found in experiments at the Chicago Experimental Filtration Plant.

Complete degeneration of myelin sheath segments of the nerves resulting from strong alcoholic intoxication is permanent, but the slight irritative changes from mild daily intoxication are quickly repaired, Dr. C. C. Speidel, University of Virginia Medical School, learned from observation of frog tadpoles.

A new precise method for destroying successive layers of nerve cells from the brain cortex, thus greatly facilitating the study of localization of functions, was announced by Dr. J. G. Dusser de Barenne, Yale School of Medicine.

Alcoholic neuritis, serious nervous disease resulting in paralysis and often death, is due to lack of food and not to the poisonous effect of the alcohol on the peripheral nerves of the body, Dr. Maurice B. Strauss, Thorndike Memorial Laboratory, Boston, reported.

Scurvy-preventing vitamin C is manufactured in the body of infants up to the age of five months, Paul Rohmar, N. Bezsonoff and Ursula Sanders, of the medical faculty of the University of Strasbourg, reported.

Spectrum analysis of vitamin E, which makes possible the identification of this food factor by physical measurement as well as by feeding experiments with animals, was accomplished for the first time by Drs. A. J. P. Martin, T. Moore, Marion Schmidt and F. P. Bowden, Dunn Nutritional Laboratory, University of Cambridge, England.

A new rickets-preventive was found in cholesterilene sulfonic acid, chemical relative of vitamin D, Professor Lester Yoder, Iowa State College and Iowa Agricultural Experiment Station, announced.

A dietary factor which can prevent hemorrhage in chicks and may be a new, hitherto unknown vitamin was found in seeds and cereals by H. Dam of the Biochemical Institute, University, Copenhagen.

Tetany, severe nervous and muscular disease featured by painful muscular cramps and not to be confused with tetanus or lockjaw, can be cured or greatly relieved by treatment with "A.T.10," a chemical fraction of irradiated ergosterol or vitamin D, Dr. I. Snapper, professor of medicine and general pathology, University of Amsterdam, reported.

A thermocouple that gives the temperature of air deep in the lungs by measuring the temperature of each breath was devised by Dr. Francis G. Benedict, director of the Boston nutrition laboratory of the Carnegie Institution.

Verification of the fact that the blindness-causing form of the tropical disease, onchocerciasis, is widespread in the Belgian Congo and that about one third of the wild-flies, regarded as chief carriers of the malady, are infected with the disease, was made by a Harvard University expedition under the direction of Dr. Richard P. Strong.

Azo-chloramide, new germicide and disinfectant that kills bacteria without injuring living tissues and does not break down in the presence of organic matter, was announced by Dr. Franz C. Schmelkes and associates of Wallace and Tiernan Research Laboratories, Belleville, N. J.

Psychology and Psychiatry

Learning of the simple type known as "conditioned reflex" may take place when the brain cortex is completely missing, but a form of conditioning involving adaptation was found to depend upon functioning of the cortex in dog experiments by Dr. Elmer Culler, of the University of Illinois.

The association area of the frontal lobes of the brain is essential to memory of the immediate past, or ability to keep in mind several aspects of a problem while seeking the solution, it was learned from experiments with apes and monkeys performed by Drs. C. F. Jacobsen and J. B. Wolfe, Laboratories of Comparative Psychobiology, Yale University.

High frequency radio currents were used by Dr. Clarence W. Brown, of the University of California, to block out certain nervous centers of the brain for study of their functions without pain or injury to the animal involved and without affecting the higher cortical centers of its brain.

The successful planting of small coils beneath the skin on the heads of dogs, with direct connection to the brain, made possible, by means of induced currents, the study of special functions of brain areas without pain or injury to the animals, is reported by Dr. Roger B. Loucks, Phipps Psychiatric Clinic, Johns Hopkins University.

Dr. Donald G. Marquis, of Yale University, found that complete loss of the occipital lobes of the brain does not prevent dogs from learning to respond to a signal of

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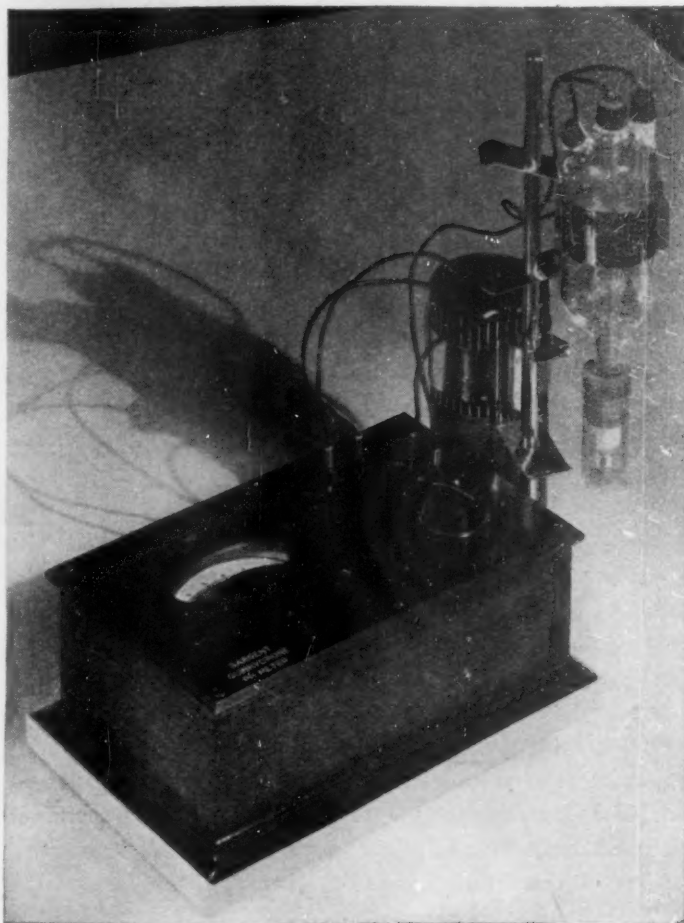
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light, although without this "visual" area the animals are unable to see objects or forms.

Salt is not a taste, but is discerned by a skin mechanism, is the conclusion of Dr. Samuel Renshaw, of the Ohio State University, who found that salt, unlike tastes, is more noticeable at body temperatures than hot and can be "tasted" on lips and gums where no taste organs are present.

Temperature is perceived not through a special skin mechanism, but through the dilation and contraction of the blood vessels, according to Dr. John P. Nafe, of Washington University, St. Louis.

An unusual case of visual defect in which the victim could not distinguish objects but saw them blurred together into one and which was cured by training in an analytical attitude was reported by Dr. D. M. Purdy, University of Kansas.

The theory that a different process makes possible the hearing of high and of low frequencies was corroborated by experiments showing that fatigue of the ear produced by a high tone affects hearing of high tones more than hearing of low tones, is reported by Dr. Clifford Pearce, Brown University.

Changing the volume of a sound changes its apparent pitch, and the apparent volume is likewise dependent upon pitch, was found independently by Dr. S. S. Stevens, of Harvard University, and Dr. Harvey Fletcher, of the Bell Telephone Laboratories.

A clue to fundamental differences in physiological brain conditions underlying mental deficiency was found by Dr. George Kreezer, Vineland Training School, in the way in which the muscles of idiots respond to mild electric currents, their reaction resembling that of an animal with injury to higher brain centers, or that of an undeveloped fetus.

The intelligence quotients of exceptionally bright children decrease as they grow older and girls lose more than do boys, has been found by Professor Edward A. Lincoln, of the Harvard Graduate School of Education.

Samuel D. Robbins, director, Boston Stammerers' Institute, believes that intelligent children who are delayed in learning to talk are often sufferers from a short auditory memory span and should be taught only words containing very few sounds.

Diabetic children taking insulin treatment are normal in intelligence was found by Dr. Howard West, Amytis Richey, and Mary B. Eyre, Claremont Colleges.

No matter how well a skill, such as piano playing is learned, the more making of one movement is not sufficient to call forth the next and neither does consciousness of what you are doing lapse after learning, was found experimentally by Dr. Walter S. Hunter, Clark University.

A comprehensive photographic atlas of infant development was completed by Dr. Arnold Gesell, assisted by Drs. Helen Thompson, Catherine S. Amatruda, Jessie J. Carlson, Alice V. Keliher and Frances L. Ilg, all of the Clinic of Child Development, Yale University.

Athletic and mental training beginning at the age of twenty days for one of twins and at 22 months for the other, demonstrates that critical periods exist when certain types of skill or knowledge can best be learned, is

the conclusion of Dr. Myrtle B. McGraw, Babies Hospital, New York.

Engineering

The giant Cunard-White Star liner, the 543, 1,018 feet long and with expected speed of 33 knots, was launched and christened the *Queen Mary* by Queen Mary herself.

New record for North Atlantic crossing by steamship was made on November 5 to 9 by the North German Lloyd liner *Bremen*, which went from Cherbourg to Ambrose Light off New York in 4 days, 14 hours and 27 minutes.

A new type of direction finder for ships incorporating a cathode ray oscillograph was devised by L. H. Bainbridge Bell, of the British Government Radio Research Station.

Streamlined, high-speed trains planned and started in 1933 were completed and a record was made by the Union Pacific's M-10001 in a trans-continental journey from Los Angeles to New York City in 56 hours and 55 minutes.

While the new streamlined trains were breaking speed records throughout the country the regular steam train of the Chicago, Milwaukee, St. Paul and Pacific Railroad streaked between Chicago and Milwaukee at the average speed of 90.6 miles an hour for the 69 miles, attaining top speeds of 103 miles an hour.

Construction was begun on a new tunnel beneath Hudson River in New York City, off West 39th Street, which will duplicate the present Holland tunnel through which more than 75,000,000 vehicles have passed.

Queensway, the largest and longest vehicular tunnel in the world, was opened between Liverpool and Birkenhead in England.

New railroad tunnels include: Eleven and a third mile long Apennine tunnel of the Italian State Railways and the Moffat tunnel of the Great Northern Railroad across the Continental Divide putting Denver, Colorado, on a main transcontinental line.

All-time construction record for pouring concrete was established at Boulder Dam when 10,462 yards of "liquid stone" was placed in one day.

Six new bridges of major importance were under construction in the United States, including Golden Gate and Oakland bridges both at San Francisco; a bridge across the Mississippi River at New Orleans, and Astoria bridge on the Columbia River, and the bridge across Narragansett Bay and Tri-Borough Bridge, Manhattan.

The world's largest camera, 31 feet long and weighing 14 tons, was placed in operation by the U. S. Coast and Geodetic Survey for copying nautical and aeronautical charts.

The shoal water fathometer, an improved "echometer," which will measure ocean depths less than 120 feet with an accuracy within one inch, was developed by the U. S. Coast and Geodetic Survey.

By use of short-wave radio telephone the United States and Japan were linked in direct voice communication between any telephone in either country.

Radio waves of half inch length, the shortest produced by radio tubes up to that time, were used by Drs. C. E. Cleeton and N. H. Williams, of the University of Michigan, to measure the ammonia molecule.

Marchese Guglielmo Marconi, "father of wireless," invented a new type of radio beacon, using microradio waves only a few centimeters in length, for the navigation of fog-bound harbors.

A system of radio facsimile transmission of photographs which uses a stylus and carbon paper to receive and record the wireless-sent picture, in a few minutes instead of an hour, was developed by engineers of the R. C. A.-Victor Company.

A stringless piano, producing tones by electrical vibration and amplification of short steel slivers, was produced commercially.

Electric incandescent lamps, containing two filaments, which may be used either singly or in combination, were made available commercially.

An improved high-speed flashing 1,000-watt light for use in searchlight signalling contains hydrogen and makes it possible to send dot and dash messages twice as rapidly with half the number of errors.

A new stress recorder apparatus for use on engineering models subjected to artificial earthquakes was developed by A. C. Ruge, of the Massachusetts Institute of Technology.

An electrical apparatus that has persistence of vision, is sensitive to ultra-violet and infra-red radiation and allows electrical magnification of an image, was developed by Dr. V. K. Zworykin, R. C. A.-Victor Company engineer.

Georges Claude, French inventor, sailed for the Brazilian coast with a ship adapted for ice-making which gets its power by utilizing the difference in temperature of the surface and bottom water in tropical oceans.

All-metal radio tubes, rugged and durable, were commercially available for the first time in 1934.

"Peanut" tubes, hardly larger than a shoe button, opened new possibilities for the development of pocket radio sets for broadcast listeners.

Short-range, short-wave radio receivers by which laymen can converse over a distance of 12 miles, were made available.

Facsimile transmission of pictures, text and engraving by radio and wires reached commercial realization in newspaper offices.

A coaxial conductor, or concentric circuit, has been developed by the Bell Telephone Laboratories, which will transmit a band of frequencies one or two million cycles wide and can provide either for the multi-channel transmission of about 200 telephone messages or for wire transmission of television.

A method for dissipating fog was demonstrated at South Dartmouth, Mass., by H. G. Houghton, of the research staff of the Massachusetts Institute of Technology.

The \$100,000,000 Hetch Hetchy aqueduct supplying San Francisco with water was dedicated.

The world's largest ship elevator taking vessels of 1,000 tons was completed at Neiderfinow in Germany on the canal-linking Berlin with the Baltic Sea.

The tremendous increase in gold mining during 1934 led to the introduction of the flotation method in treating gold-bearing ores.

The deepest oil well in the world was drilled in California reaching a depth of 11,000 feet.

Construction was begun on the Fort Peck Dam on the upper Missouri River. Its 100,000,000 cubic yards of earth will make it the largest dam of its type when finished.

Dr. Charles H. Herty and Morris R. Poucher developed a process for making rayon from Southern slash pine based on their previous work in making newsprint from the same source.

Increased adoption of dieselectric engines for power in high-speed light-weight trains occurred within the year 1934.

A special camera was developed which makes it possible to take detail pictures showing the characteristics of lightning and thus show the method of formation of the stroke, the rate of propagation and the number of multiple strokes in a single lightning flash.

A 400,000-volt x-ray tube was developed which is not dependent on a vacuum pumping system for operation. This raises by 100,000 volts the range of industrial radiography where vacuum systems can not be tolerated as a part of the x-ray equipment.

Aeronautics

Despite the accident in the ascension of the Army Air Corps-National Geographic Society's balloon, the *Explorer*, in its stratosphere flight, Captain A. W. Stevens, Major William Kepner and Captain Orvil Anderson brought back valuable information about the upper air including: temperature and barometric data from the ground to the 60,613-foot altitude reached; records of sky brightness at various heights; data on cosmic rays; in addition to contributing materially to the technique of handling large balloons.

Examination of the fabric of the ill-fated balloon, *Explorer*, used in the National Geographic Society-Army Air Corps' stratosphere flights disclosed that the cause of the disaster rip could be attributed to the new way of folding part of the bag inside the envelope with accompanying sticking-together of the rubber-coated material.

Professor and Mrs. Jean Piccard, stratosphere balloonists, reached altitude of 57,579 feet in an ascension which obtained valuable cosmic ray data for Professor W. F. G. Swann, of the Bartol Research Foundation.

Two fully automatic variable pitch propellers, one a constant thrust propeller built by the Eclipse Aviation Corporation, and the other a constant pitch propeller, announced by the Hamilton-Standard Propeller Company, will further increase efficiency and safety in flying.

Commendable performance by many wingless autogyros, such as those of Rohrbach, Strandgen, Platt and Chapedelaine, foretells increased use for this form of air transport.

Autogyros and gyroplanes, machines supported by a supplementary rotor from power derived from the motion of the propeller, will be superior to conventional aircraft as soon as their possibilities for high speed are developed, is predicted by John B. Wheatley, National Advisory Committee for Aeronautics.



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SCIENCE NEWS

Science Service, Washington, D. C.

A NEW PLAN FOR THE PRODUCTION AND TRANSMISSION OF ELECTRICAL POWER

BY WATSON DAVIS

Director, Science Service

ELECTRICITY generated by enormous disks spinning in vacuum and "piped" unlimited distances along vacuum-surrounded rods, carrying cheap energy from great water power developments or coal and oil fields to the centers of population, is the possibility held out by Dr. Karl T. Compton, chairman of the Science Advisory Board, in a research project recommended to President Roosevelt for federal financing.

This revolution in both the making and the transporting of electricity has been in the making for the last five years. Young Dr. Robert J. Van de Graaff is the scientist mainly responsible. The 10,000,000-volt electrostatic generator built by the Massachusetts Institute of Technology at Round Hill, Mass., is the first step toward an electrostatic generator suitable for commercial power production. The transmission system proposed, an airless pipe with a rod running through it, has probably been tested but no experimental results have been announced.

Dr. Compton in a description originally prepared over a year ago and just made available as a part of the Science Advisory Board report proposed "a radically new scheme for electric power transmission" because present methods of transmitting electrical power are limited by practical reasons of efficiency, complexity and cost to about 250 miles. The new system should be "cheaper to install than the present systems and should be capable of transmitting power to unlimited distances without appreciable loss."

It is known that there is some hope that the Tennessee Valley Authority with its large power developments may benefit from this radically new development. Several hundred thousands of dollars would finance a serious effort to develop the new scheme to the stage of useful application. The project is described as "planned and ready to start under competent supervision on short notice."

Instead of alternating current that the now-standard electromagnetic generators produce at high voltage, the new proposed generators would give out direct current at about a million volts.

The giant disks of the electrostatic machines would be surrounded by vacuum because of the necessity of preventing tremendous sparks that might wreck the whole equipment if they were allowed to occur. The great progress that physicists have made in recent years in producing high vacuum in large spaces will contribute materially to the success of the new scheme.

If this new power production dream is realized, it will be a case of progress turning the clock back, in a sense. For the electrical machines that were used in the eighteenth-century by Benjamin Franklin and others were of the electrostatic type. They generated electricity by

friction on large disks. All modern electrical generators and motors employ the principle of electromagnetics instead of electrostatics.

In the experiments with the ten-million-volt electrostatic generator already built, the accent has been upon its usefulness for producing artificial lightning to smash atoms and conduct research in physics. The commercial application of the scheme has been an objective about which there has been little discussion and still less definite announcements.

FOG DISSIPATION

A REPORT on a chemical method of fog dissipation by water-absorbing material, a project sponsored by the American Philosophical Society, was made to that body, meeting in Philadelphia, by Professor Edward L. Bowles and Henry G. Houghton, Jr., both of the Massachusetts Institute of Technology.

Recently at Round Hill, South Dartmouth, Mass., Professor Bowles and Mr. Houghton successfully completed their first tests when, by spraying a saturated solution of calcium chloride through specially designed nozzles, they cleared a sizable path through a pea-soup fog. Professor Bowles described the general program of research at Round Hill, with emphasis on the experiments with fog. Mr. Houghton discussed the specific problem of dissipation.

The individual fog particles were found to range in size from two twenty-five hundredths to one twenty-five thousandths of an inch in diameter, the smallest being only slightly greater in diameter than the wave-length of red light. The size of the smallest of these particles is indicated by the fact that 25,000 of the droplets could be placed end to end within the space of one inch.

Measurements and photographs of the particles by microscopes were made by Mr. Houghton and Dr. Julius A. Stratton, who with Mr. Houghton did much of the work preliminary to the dissipation project. Natural fog was allowed to drift across a flat glass slide on which the microscope was focussed while an extremely thin coating of grease on the slide caught individual particles and prevented the droplets from spreading. Fine lines were ruled upon this glass slide for measurement.

Fog is composed of particles of various sizes with one size usually predominating, it was found. This predominating particle varies with different fogs. It was formerly believed that fog is composed of particles of discrete size.

It was also found that salt, invisible grains of which are tossed into the air from breaking waves, are the cause of most sea fogs. These fine particles are the nuclei on which the infinitesimal droplets of fog condense.

As his research advanced, Mr. Houghton said, he began experiments on the dissipation of fog by means of laboratory apparatus which included an artificial fog chamber with equipment for generating fog. In one of his earliest experiments, he found that a gram of cal-

calcium chloride powder was capable of clearing about three cubic meters of specific fog air at 20 degrees Centigrade, proving the feasibility of attempting a large scale application. This experiment also solved the question of the mechanism of dissipation by showing it to be due to a lowering of the vapor pressure and not to a physical sweeping action, although after a time there may be some sweeping action by the falling drops.

No effort has been made, Mr. Houghton said, to determine the approximate cost of clearing a given area for a specified time. From his experiments, however, he is positive that it is well within the realm of practicability. In the actual test on an actual fog at Round Hill, a 100-foot pipe fitted with its special nozzles at frequent intervals was suspended horizontally 30 feet above the ground. A fog bank driven by a southwesterly wind at 13 miles an hour drifted in from Buzzard's Bay, limiting visibility to less than 500 feet.

When the fog had completely enveloped the region, pumps driving the chemical solution to the distributing system were started and a fine spray of calcium chloride solution began falling from the long pipe. Within a few seconds fog drifting through the chemical curtain began to precipitate, falling to the ground in the form of water drops.

Immediately a path of visibility 100 feet wide and 30 feet high began to open across the airport at Round Hill in a northwesterly direction. On either side were walls of turbulent white vapor, but in the cleared area the ground was entirely free of fog. Within a few minutes objects more than 2,000 feet away were clearly revealed. The path was clear as long as the chemical curtain was operated. It was several minutes after the pumps had stopped before the fog began to close in again.

IMMUNIZATION AGAINST INFANTILE PARALYSIS

WITHIN one week a group of New York City children had immunity to dread infantile paralysis as a result of small doses of infantile paralysis virus made harmless by formalin, according to a report made by Dr. Maurice Brodie of New York University and the New York City Health Department before the Chicago meeting of the Society of American Bacteriologists.

Before receiving the protective doses, almost all the children had in their blood a small amount of virus-neutralizing material. Three weeks later, the amount of this neutralizing material had increased to the point where the children's blood was capable of neutralizing from 100 to 600 additional infective doses of virus. Before giving the immunizing doses, the method was tried on six volunteers from the New York City Health Department Bureau of Laboratories. Neither these adults nor the children suffered any unfavorable results.

Grown persons develop immunity to infantile paralysis as a result of exposure to the disease, and not just as a result of growing up, as has been suggested. Evidence in favor of the theory that immunity results from exposure was presented by Dr. Brodie and Dr. William H. Park, director of the research laboratories of the New York City Health Department.

The blood of monkeys of different ages was tested for ability to neutralize the infantile paralysis virus. Neither old nor young monkeys possessed any neutralizing power. This seems to show that these animals, which have little or no opportunity for exposure to the virus, fail to develop immunity as they grow older. On the other hand, blood of 27 out of 34 adults who had probably been exposed to the virus showed considerable neutralizing power. Those with a history of frequent exposure to the virus showed slightly higher average neutralizing power than those who had no knowledge of contact with infantile paralysis.

THE ISOLATION OF NEW DISEASE-PRODUCING STREPTOCOCCI

A NEW member of that well-known and dangerous germ family, the streptococci, has been found in the throats of persons suffering from rheumatic infection and a type of kidney disease, according to a report made by Drs. Perrin H. Long and Eleanor A. Bliss, of the Johns Hopkins Medical School, to the Society of American Bacteriologists at Chicago.

The new streptococci are much smaller than their other relatives and have been given the name of minute beta hemolytic streptococci. But the frequency with which they inhabit throats of patients suffering from these two diseases suggests that they may be fully as harmful as the larger variety of streptococci. The larger streptococci have been thought to be the cause of both rheumatic infection, this particular kidney disease, and various other ills.

In two instances these minute streptococci were the sole cause of pus infections in humans. They were found in the throats of four-fifths of a group of patients suffering from the type of kidney disease known as glomerular nephritis and in the throats of half the patients suffering with rheumatic infection. They are rarely found in the throats of persons ill with chronic diseases or other acute infections. In well persons their number is only from one half to one third that of the ordinary beta hemolytic streptococci. But in the patients suffering from rheumatic infection and from the kidney disease these minute organisms greatly outnumbered the larger beta hemolytic streptococci, in many cases being the only hemolytic streptococci found.

Because of the well known association between the larger streptococci and both the kidney disease and rheumatic infection, Drs. Long and Bliss feel that their findings may be of considerable importance.

RECORDING OCEAN WAVES

A RECORDING current meter, which will keep a complete record of intensity and direction of ocean currents, and by which it is hoped to be able to forecast destructive waves, has been devised by Dr. George F. McEwen, professor of physical and dynamical oceanography at the Scripps Institution of Oceanography, La Jolla, Calif.

No instrument now in use keeps a time record of current changes, Dr. McEwen stated, in explaining his new machine, now in its experimental stage on the pier at the institution. The device, which operates on the principle of a pendulum, consists of a perforated sphere set on

gimbals free to move in two directions. The extent of the movement is recorded on a revolving waxed cylinder, according to Dr. McEwen. "From the movement thus recorded along two lines at right angles to each other we can easily compute the resultant line, which gives us direction and intensity of the current." He explained that the new instrument is designed to compile data on current movements for use in studying causes of the huge waves which have rocked the coast of Southern California and on occasions caused property damage.

Attached to the apparatus, which weighs 200 pounds in all, is a magnetic needle which automatically locks after becoming settled, so that the compass direction of the currents is known.

The disk on which the record is made is rotated by another cylinder filled with oil and containing a plunger. As the oil seeps by the plunger an attached weight slowly lowers, turns the disk, and locks the compass. Dr. McEwen anticipates constructing a similar device for measuring winds and air currents. While the present instrument is now recording currents near shore at La Jolla, he hopes soon to equip ships with similar ones.

According to Dr. McEwen, the giant waves in this region are caused by a combination of coastal oscillations and long sloping waves coming in from hundreds of miles out at sea. "We don't know much about these currents yet," he said, "but once we have these instruments stationed in key positions along the coast we shall be able, at least, to forecast disasters."

ALPHA-DINITROPHENOL

DANGER may lie in wait for the person who tries to reduce by means of a simple method widely publicized during the last eighteen months.

Warning to doctors, press and public against the indiscriminate use of this drug, called alpha-dinitrophenol, is issued by the *Journal of the American Medical Association* in an editorial in the current issue. Three persons have died and many others are experiencing ill effects from the use of the new method of reducing. Some 100,000 persons in the United States have been treated with this drug in the past year, it is estimated, in the belief that here at last was a method of reducing excess weight which was free from serious after-effects. The drug burns the extra body fat and carbohydrate without affecting the protein, the medical journal says. However, reports of its toxic effects have already persuaded many doctors to stop its use until the results of further studies are known. Skin rashes are among the unpleasant and sometimes alarming after-effects of the use of the drug. It seems to have no bad effect on the liver or on the circulation, but investigators believe it needs careful watching as to possible injury to the red blood cells.

The drug can be purchased at any corner pharmacy, and the medical journal regrets the fact that no restrictions have been placed upon its sale. One of the big points in its favor when the use of the drug as a reducing method was first announced was the ease of its administration. The fat man or woman merely swallowed three capsules a day and within three months or so normal weight was achieved.

The editor of the medical journal urges that the sale of alpha-dinitrophenol be restricted to that ordered by doctors' prescription and that its use by medical men be carefully supervised. Probably it should be used by the physician, the journal states, only when reduction of weight is important for health and when ordinary dietary methods have failed.

ITEMS

THE following forecast of this winter's temperature has just been received by Dr. Charles F. Brooks, director of the Blue Hill Observatory, Harvard University, from Dr. Franz Baur, director of the governmental long-range forecasting bureau of Germany, at Frankfurt-am-Main: "The past and present world weather conditions permit us to expect, with ninety per cent. probability, that the winter of 1934-35 in the northeastern part of the United States of America (New York and New England) will be mild; that is, that the mean temperature of the winter months December, January and February will lie more than one half degree Fahrenheit above the average of the last sixty years."

THICKNESS of the Antarctic ice crust that blankets the world's southernmost land is being successfully detected by seismic soundings says a radio report from Little America from the Byrd Antarctic Expedition to the National Research Council. Thomas C. Poulter, professor of physics at Iowa Wesleyan College and senior scientist of the expedition, reports good results with the scientific work in the Antarctic, and says, "we will soon be starting back in possession of most of the data we set out to get." Unforeseen difficulties caused a few scientific projects to be abandoned, says the dispatch, but others have assumed much greater proportions than was anticipated. Regarding thickness of the ice, a point of great scientific interest, Professor Poulter radios: "I am pleased to report that the seismic soundings are coming along nicely, and that we have to date about three hundred fifty soundings distributed over eighty stations. The method is proving very satisfactory and giving the ice thickness, whether it is floated or grounded, and if floating, the thickness of the water layer, as well as something of the stratification of the underlying rock."

BREEDING experiments conducted at the Munich Zoological Garden have succeeded in producing a young horse resembling in every respect one of the two extinct horse species that roamed Germany when the country was still a wilderness. The Munich animal is a cross between the still-existing brown wild horse of the Siberian steppes and a descendant of the gray "tarpan" of southern Russia, extinct in its pure line since 1879. In both juvenile and adult coat colors and markings the "re-built" wild horse is said to be an exact counterpart of its vanished forebears. Success is also announced in "rebuilding" the aurochs, a species of wild cattle abundant in Europe during ancient and medieval times, but extinct since the seventeenth century. The results of these breeding experiments are discussed by Dr. H. W. Frickhinger, of Berlin, in *Die Umschau*.

SCIENCE NEWS

Science Service, Washington, D. C.

THE ENERGY OF COSMIC RAYS

WHERE do the enormous energies observed in cosmic rays come from? Newest of all problems in atomic science is to figure out how the ray energy is released.

Cosmic rays have been observed, for example, so energetic and piercing that they pass through nearly 2,000 feet (600 meters) of sea-water.

Professor A. H. Compton, of the University of Chicago, now of the University of Oxford, England, has estimated in *Nature* that some of the most piercing cosmic rays have energies of 600,000,000,000 electron volts. Such great evidences of energy, Dr. Compton points out, can not come from the release of the energy equivalent to the mass of most atoms known on earth. It would require atoms from 100 to 1,000 times as heavy as those of hydrogen to produce such rays by exploding. Heaviest of all atoms on earth are those of uranium weighing only about 238 times as much as hydrogen.

Dr. Compton pictures such rays as primary ones coming in from outer space and not as secondary ones created in the earth's atmosphere. They can not, definitely, be photons of radiations.

Photons are the little so-called packets of radiation, of which ordinary light is only one kind, which have been suggested as the cause of cosmic rays. Dr. Compton's 600,000,000,000-volt cosmic rays, by contrast, are thought to be electrified particles.

Those investigators who like to retain the idea of cosmic rays being photonic in nature have speculated on complex chain reactions within matter as cosmic rays pierce it. Such chain mechanisms seek to explain how super-penetrating power of the rays is possible with photons far less energetic than observations would indicate.

Just before Dr. Compton's report, and also in *Nature*, H. J. Bhabha, Indian physicist now at Cambridge, England, described such a hypothetical chain mechanism. He pictures an incoming cosmic ray photon striking atoms of matter and turning into a neutron with little loss of energy. The neutron, like a microscopic billiard ball, flies forward with great energy and with little ionizing power. In traveling through a yard of lead, Mr. Bhabha estimates, some 25 such interchanges between photons and neutrons would occur; the one turning into the other alternately.

This scheme would lower materially the loss of energy as a cosmic ray goes through matter, for about half the time it spent in the material it would be in the form of neutrons and lose little energy. Thus the final power of the ray, as measured by its ionization, would be much more than its real energy if such a mechanism were not acting.

Dr. Compton, in discussing such chain mechanisms, points out that "The apparent absence of any possible mechanism whereby such a chain reaction might be effected seems sufficient to rule out such suggestions."

PHYSIOLOGICAL EFFECTS OF RADIATION

NEW scientific tools for investigating how well radium rays and x-rays act on the human body have been developed by the National Bureau of Standards. The apparatus, using blocks of wax instead of the human body to scatter the rays, and a mixture of three fluids having atomic patterns similar to the body tissues to absorb the radiation, may prove useful in helping to decide the old question of when to use and when not to use radium in treating deep-seated cancerous tissue.

Often radium rays work better than x-rays, but frequently the opposite is true. Physicians, in the past, have only been able to determine this fact by actual body therapy. Now, it is hoped, a laboratory test can decide the problem in advance of treatment.

Lauriston S. Taylor, head of the section of x-rays standardization, and Dr. F. L. Mohler, head of the section of atomic physics of the bureau, are the developers of the new ray-measuring equipment.

"While it has been possible," Mr. Taylor said, "to measure separately the ionization of radium and x-rays it has not been possible to compare accurately the results of two such tests and decide definitely when and where each may be most efficiently utilized. Any suitable method of measuring these rays must be carried out under conditions which physically are the same as those encountered by the radiation when it enters the body. To accomplish this we have constructed apparatus which measures the radiation in liquids instead of gases. These liquids have the same atomic properties as the body tissues." The fluids, he added, are carbon bisulphide, tetrahydronaphthalene and a fluid obtained from oil refineries, known as ligroin.

A fine, screen-like mesh of wires properly insulated is immersed in this combination liquid and the ability of the rays to ionize atoms by knocking off electrons is measured. It is a similar ionization of atoms in the body which makes radium and x-rays effective in treating cancer.

Below the ionization screen, Mr. Taylor explained, are a series of wax blocks which scatter the rays backward after the fashion of the human body in radiation therapy. These wax blocks are known as "phantom" bodies and take the place of a real body in the actual tests.

"STALLED AIR"

"STALLED AIR," a persistent stagnation in the atmosphere, with the country largely blanketed with a great warm air mass, was the cause of the fog that has grounded airplanes, slowed rail schedules and caused auto wrecks for several days, according to C. L. Mitchell, of the U. S. Weather Bureau.

A long drift of warmed air from the southwest brought about a condition of general cloudiness and thin rains. This, in itself, is not an abnormal or unusual occurrence in winter, Mr. Mitchell explained. What brought the fog

was the apparent inability of this sluggish air mass to move.

The fog came because the heated moist air condensed over the cooler land and water of the Northeast. Such condensation occurs because of the presence of microscopic particles in the air which serve as nuclei. Atoms in the atmosphere from which one electron has been removed so that they become electrical ions are a common type of nuclei. Dust and soot particles from many chimneys also form convenient places at which moisture in the air can condense.

The dense fogs found in industrial cities known as "smoggy" weather—a combination of the words smoke and foggy—occur for this last reason. Much of the fog in the East may have been due to this "smog" for during the winter the air is especially filled with ash and unburned coal particles.

The foggy condition has been general over practically the whole of the Appalachian mountain region and the Atlantic seaboard. Fog has also been reported from as far west as Omaha; but the trans-Appalachian region has not been under a continuous shadowy blanket.

THE FEDERAL FOOD AND DRUG ACT

TIGHTENING up of the Federal Food and Drugs Act on thirty-six specific points is urged by the American Medical Association through its board of trustees, the council on pharmacy and chemistry and the committee on foods.

Clamping down on extravagant claims made over the radio and in printed advertisements for foods, cosmetics, drugs and certain devices is necessary to protect the health and pocketbooks of the American people, the *Journal* of the American Medical Association states in its current issue. Within the thirty years that have passed since the food and drugs laws was enacted, there have developed advertising agencies, the radio, and many other new forms of approach which make new legislation desirable.

It is believed the doctors would not place on publishers or owners of broadcasting stations the responsibility for exaggerated or untruthful claims. Responsibility should rest with the individual or firm issuing the products.

A few of the important changes advocated are:

1. Extend the provisions of the law to include cosmetics and cosmetic advertising.
2. Ban the use of testimonials of a health, medicinal or therapeutic character in food advertising by persons unqualified to express a scientific opinion.
3. Require all drug testimonials to be accompanied by the name and address of the writer and consider such testimonials the claims of the advertiser.
4. Prohibit the mention of the names of diseases on the labels of drug preparations unless the drug is a cure.
5. Extend the scope of the word "drug" to include devices, substances and preparations intended to "affect" the structure or any function of the body or the treatment of disease.
6. Require declaration and warning on the labels of habit-forming drugs.
7. Prevent the use of resinous glaze or shellac to cover candy.

8. Prohibit the use of artificial colors in food other than those certified by the Department of Agriculture.

9. Class as adulterated food prepared under unsanitary conditions.

10. Authorize the fixing of tolerances for any added or natural poison in or on food, and if dangerous ban the food whether the constituent was added by man or exists there naturally.

GENERAL HEALTH AND THE DEPRESSION

THE economic depression of the past few years has not lowered the general health of the people of the United States, according to the report made to the Congress by Dr. Hugh S. Cumming, Surgeon-General of the U. S. Public Health Service.

The two chief factors which have kept the country healthy are "the vast work of the relief agencies and the fortunate absence of wide-spread epidemics," he said.

The lowest death rate ever recorded in the United States was for the calendar year 1933, the last half of which is covered by the Surgeon-General's report. Health conditions remained comparatively good for the first half of 1934 but the death rates for many localities were higher than in the preceding year.

Those whose health was most affected by the depression were members of the families which had been in comfortable economic circumstances before 1929 but which since then have been reduced to the lower economic class. This was learned from a series of studies by the U. S. Public Health Service in ten localities where the depression was most severe.

Death rates for tuberculosis, typhoid fever and diphtheria reached new low marks for the calendar year 1933.

"The participation of the Public Health Service in the Civil Works program was an outstanding activity during the year," the Surgeon-General reported. "Through the use of work relief labor, assistance was given to 14 states in malaria-control drainage work, in which 6,000 miles of ditching was carried out. In these states there are approximately 2,000,000 cases of malaria each year and the annual loss therefrom is estimated at half a billion dollars. Under the Civil Works program and aid, more than 225,000 sanitary outdoor toilets for rural homes were constructed in 22 states, the material being furnished by the home owners.

"In the field of public health, new problems constantly arise and new dangers appear, such as those illustrated by the unusual type of encephalitis appearing in St. Louis in 1933, the extensive outbreak of amoebic dysentery in Chicago, and the necessity for the control of distillery wastes which are now being emptied into already heavily overtaxed and polluted streams, thus seriously affecting the water supplies of the country. Constant vigilance is required for the early detection and study of these new continually arising dangers to the public health in order successfully to combat them."

THE USE OF RUBBER IN THE AUTOMOBILE INDUSTRY

CURT SAURER, of the Firestone Tire & Rubber Co., speaking at the recent meeting of the Society of Auto-

motive Engineers, told what uses rubber finds in modern automobiles; and what the future holds.

The best recognized use of rubber—in tires—is only one of about twenty important places where rubber enters the construction of an automobile.

Drive along a road, hit a bump and the tires absorb the first shock. Helping the tire take up the impact is the spring between the axle and body. And between the axle and spring many cars have a layer of rubber to help absorb the shock. In the future, Mr. Saurer reports, it may be possible to remove the spring entirely and ride on rubber. The future may also bring a rubber mounting between the motor and the running gears of the car and between the gear box and the wheels. Such installation would further aid in silencing a motor car.

As you guide the car with a hard rubber steering wheel, step on the brakes if the emergency arises. More often than not, your foot will come down on a rubber-covered brake or clutch pedal. And the pressure moves an intricate system of rods and levers made silent and rattle-proof with rubber. Even in the brakes themselves is rubber, for the brake linings of to-day use rubber as the binding material within them.

Well known, Mr. Saurer points out, is the sound insulation provided by rubber sheeting which takes rattles and squeaks out of the joints between the separate parts of a car body. In front of the car is the radiator and with it the cooling system of the automobile. Rubber goes into the radiator hose. Newest change in this part of the car is hose with an outlet valve used as a drain or for installing hose leading to the hot water heater system for winter driving. Familiar are the uses of rubber as electrical insulator in the ignition system of all cars. Known too are rubber windshield wipers and rubber coating on the running board.

Cars of the future, Mr. Saurer believes, will also have a rubber covering on the under side of the mud guards to protect the metal from the impact of stones and to reduce the noise of such impacts.

Rubber seat cushions have not yet come for automobiles but the problem is being investigated. Perhaps such seats will come as some form of the familiar sponge rubber, perhaps as rubber threads. One may someday ride while sitting on a pile of rubber bands.

ITEMS

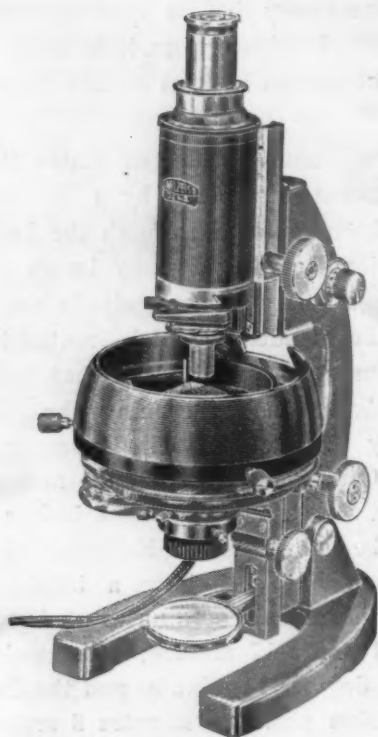
A CABLE from Copenhagen reports that a comet, just discovered at Union Observatory at Johannesburg, South Africa, by Astronomer E. L. Johnson, is the first of the new year. But it is not visible from the northern hemisphere, and even south of the equator a telescope of some size is necessary. It will be called Johnson's comet. The astronomical location of the presumably new comet is right ascension one hour and south declination 51 degrees three minutes, which means that it is in the southern constellation of the Phoenix. Its brightness is reported as 10.4 magnitude, whereas an object in the sky must be sixth magnitude in order to be seen by keen, unaided eyes. News of the discovery, made late on Tuesday night (January 8), was reported to the central bureau for astronomical information at Copenhagen,

whence astronomical news is cabled to the observatories of the world. The comet is moving about a degree a day southward, but more observations and extensive computations will be necessary before astronomers can say whether it will grow brighter, when it is likely to return, or how long it will remain with us at this time.

A SECOND cable from Copenhagen states that a new object in the heavens, discovered by a British amateur astronomer, has been reported through the International Astronomical Union Bureau. It may be an asteroid or a comet. Although it is tenth magnitude and too faint to be seen with the unaided eye, it is located in the constellation of Taurus, the bull, somewhat west of the bright star Aldebaran in the evening sky. Discovered on January 6 by Geoffrey Francis Kellaway who lives in the Somerset County of England, the new object was confirmed by Dr. A. C. C. Crommelin before being reported. It will be known as the Kellaway object. The object has no tail but does have a bright center or nucleus. The astronomical coordinates at discovery were right ascension 4 hours 17 minutes 24 seconds and declination north 16 degrees 11 minutes and the daily motion is in right ascension plus two minutes 8 seconds and in declination plus one minute.

INFLUENZA cases throughout the country increased from 2,889 to 4,965 during the first week of the new year, according to reports of 38 state health officers to the U. S. Public Health Service. These official reports do not give a true picture of the influenza situation. Actually there may be 49,000 or more cases of the disease. The reported number of cases must be multiplied by five or ten or more in order to get anything like a true idea of the amount of influenza present in the country, since so very many cases of this disease never get reported, even during epidemics. Confusion of influenza with colds and grippe adds to the difficulty of determining the amount of influenza in the country. Influenza is a much more severe ailment than grippe, while the latter is more severe than the common cold.

UNUSUALLY warm weather for early January, prevailing over most of the country, has helped distressed livestock in the West and at the same time has encouraged the seeding of Southern vegetable crops for the early spring market in the East. These are outstanding points in the week's summary of weather and crop conditions, as compiled by J. B. Kincer, of the U. S. Weather Bureau. The benefits to Western range cattle came partly through added respite from winter cold, but mainly through the melting away of the snow cover from pastures which had been blanketed down, permitting the animals to graze again. Considering the distressed conditions of the past several seasons in the West, the present winter has so far been rather favorable for cattle. The drought condition on the Great Plains, however, is not yet at all adequately relieved, and conditions in the anomalous dry area from the upper Ohio Valley southward are also still serious.



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SCIENCE NEWS

Science Service, Washington, D. C.

THE NATURE OF COSMIC RAYS

NEW confirmation that cosmic rays consist, in a large measure, of charged particles streaming down on the earth from outer space has been presented before the Franklin Institute by Dr. Thomas H. Johnson, assistant director of the Bartol Research Foundation, Swarthmore, Pa. Dr. Johnson recently returned from a cosmic ray expedition to Mexico where his party climbed the 14,000-foot peak of Nevado de Toluca, fourth highest mountain in the country.

Using heavy and elaborate apparatus which measures the intensity of cosmic radiation as it varies from zenith down to horizon, Dr. Johnson detected a greater intensity from the south than from northern directions. These results tie in with his previous discovery that cosmic ray intensity also is greater from the west than the east. Both results are explainable by previously developed cosmic ray theories of Professor Carl Stoermer, Dr. P. S. Epstein and Abbé Lemaitre and Dr. M. S. Vallarta.

To explain the north and south difference of cosmic rays is the concept that the earth casts a magnetic shadow. Dr. Johnson states that, "Due to the magnetic field and to the fact that the rays are electrically charged, the orbits are curved, and, if the earth were transparent to cosmic rays, much of the intensity which would be observed at the earth's surface would be due to rays which had previously been inside the earth. From inside the earth they would be turned back by the magnetic field into the region above the earth where they would again be turned down to the observer. Rays traveling such orbits as these are, of course, stopped at their first entry into the earth's surface and their absence on the remainder of their hypothetical path, appears as a complete shadow from the directions below the horizon and as a partial shadow from directions above the horizon. The partial shadow is the more dense, according to experiment and theory, from northerly directions than southerly directions in the northern hemisphere."

OBSERVATIONS OF NOVA HERCULIS

FROM observatories throughout the world, astronomers are hurrying the study of Nova Herculis, the exploding star which shone so brightly at Christmas time. Their hurry is a race with stellar happenings on the distant star which blew up; a race which will be lost if the star fades to its former insignificance in the heavens. At Christmas time Nova Herculis was so bright only sixteen stars in all the sky were more luminous. Now it has faded out somewhat and rapid work is necessary to obtain information about it before it dies out completely.

From the international "clearing house" for stellar data at the University of Copenhagen, Science Service has just received reports obtained at observatories at Warsaw, Poland; Moscow, U. S. S. R., and Stockholm, Sweden, which were interpreted by Dr. Donald H. Menzel, astrophysicist of Harvard College Observatory.

The Soviet measurements indicate Nova Herculis is

still blowing itself apart. Material blown off from the star in its eruption is spreading out with a velocity of 625 miles a second.

From Stockholm observations on the brightness of Nova Herculis show the star went through a period of fluctuating luminosity. Recently the brightness magnitude was 2.5. Three days later its light was weaker, at 3.3 magnitude. And the following day its magnitude was back to 2.8. The weakened intensity was attributed on this occasion to strong absorption of the star's light by cyanogen molecules composed of two atoms each of carbon and nitrogen. As the star regained brightness the absorption of these cyanogen molecules diminished.

The expansion velocities of 625 miles a second reported from the Moscow observatory need to be considered in comparison with observations elsewhere, Dr. Menzel pointed out. "Emission lines of the star bordering the absorption lines showed velocities of approach of the order of only 150 miles a second," Dr. Menzel indicated. Velocities of approach are generally interpreted as the velocity with which the material blown off from the star is approaching the observer in the line of sight.

Professor Otto Struve, director of Yerkes Observatory of the University of Chicago, gave about 110 miles a second for the absorption while Professor Lindblad of Stockholm has reported 190 miles a second. Since absorption and emission lines overlap considerably it is difficult to know where the centers of the lines lie. Therefore the velocities reported depend somewhat on an observer's habits in measuring. The position of the centers of the spectral lines is the vital information from which the displacement can be measured and, hence, the expansion velocity. The relatively slow rise to maximum suggests that the lower velocities are more nearly correct.

EFFECT OF ALTERNATE FREEZING AND THAWING ON TUMOR VIRUS

FROZEN and thawed sixty times, the virus or causative agent of one kind of cancer is still potent enough to produce tumors when injected into chickens according to a report in *The American Journal of Cancer* by Professor H. E. Eggers, of the College of Medicine of Nebraska, and Dr. John K. Miller, of the Nebraska Methodist Episcopal Hospital and Deaconess Home. The work was carried out with the famous Rous chicken tumor. Although it is twenty-three years since Dr. Rous showed that this particular kind of tumor can be ground up and filtered without losing its tumor-producing quality, investigators are still uncertain as to whether the causative agent is a living substance or something in the nature of a chemical enzyme, without life, but capable of inciting changes in the body which result in cancer.

Professor Eggers and Dr. Miller started their experiments in the hope of shedding light on this problem. Because this tumor filtrate could withstand being frozen rapidly with carbon dioxide snow sixty times and sixty times thawed out without losing completely its tumor-

producing property, they believe it is probably not a living agent. It showed a resistance to freezing and thawing greater than other known living agents, such as bacteria or other cellular organisms.

They conclude that these experiments suggest the tumor filtrate's nature is of "an unorganized character," which would mean it contained no living cellular organisms. But they do not feel their work has completely ruled out the possibility that the agent is living, since the filtrate might contain organized bodies so minute as to escape the effect of sudden and repeated changes of volume.

The freezing and thawing were done with practically no oxygen present, a feature which previous similar experiments by other scientists lacked. The presence of oxygen might give the tumor filtrate greater ability to withstand unchanged in potency the freezing and thawing process.

HEART DISEASE RELATED TO ACTIVITY OF THE VAGUS AND ACCELERATOR NERVES

VENTRICULAR fibrillation, a fatal heart condition, and auricular fibrillation, also a grave cardiac disorder, have been found by the researches of Drs. Louis H. Nahum and H. E. Hoff, of the faculty of the Yale School of Medicine, to be caused by the external nerves of the heart. Dr. Nahum reported on his work to the New Haven Medical Association, of which he is the retiring president.

In normal hearts, Dr. Nahum explained, the external nerves, the vagus and accelerator, regulate the beat, but in abnormal hearts, it is these nerves acting with other agents that bring about fatal rhythms.

In cases of benzol or chloroform poisoning, and electric shock, it is the accelerator nerve, together with adrenalin liberated by the adrenal glands, that cause changes from the normal heart beat to the ventricular fibrillation. This fatal heart beat can be prevented by removing the accelerator nerve from the heart and excising the adrenal glands.

The vagus nerve, on the other hand, was found to promote auricular fibrillation. In the presence of an excess of thyroxin, from the thyroid gland, as in certain goiter patients, or in the case of electric shock, the vagus nerve, according to Dr. Nahum, becomes over-active and instead of following its usual rôle of slowing the heart, brings on the irregular auricular fibrillation.

"The general concept of the influence of the extrinsic nerves of the heart is that they regulate its rate: the vagus nerve slowing the heart while the accelerator causes the heart to beat faster, the normal rate being the resultant of these two forces," Dr. Nahum said. "All the experiments, however, have been based upon stimulating either of these nerves in animals with healthy hearts, but there has been no investigation of the grave disorders that they may and do produce. During the course of the investigation at Yale, it has been found that certain chemical substances which when injected reproduce the same effects as are obtained when the nerves are stimulated. Thus acetyl choline can, when injected, produce the effect of vagus nerve stimulation, while epinephrin

in the same way produces effects upon the heart which are indistinguishable from the action of the accelerator nerves. With the aid of these chemicals it is possible to study what part the nerves of the heart play in certain cardiac diseases. It was found that the accelerator nerve under certain abnormal conditions may cause sudden death, while the vagus nerve under other conditions may produce a serious disorder of the heart called auricular fibrillation."

ANCIENT MAN IN TEXAS

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MAN-MADE weapons buried eighteen feet underground, have been unearthed near Austin, Texas, by Professor J. E. Pearce, anthropologist of the University of Texas, and are hailed as convincing evidence that North America had inhabitants far earlier than archeologists generally concede at present. The first discovery was witnessed by Dr. E. H. Sellards, professor of geology at the university, who has studied the geologic formation of the site and pronounces the discovery "highly significant in the early history of man in this part of the world."

The objects consist of flint dart points and slivers from flint workshops scattered in quantities through various strata of an old Brushy River terrace, near Round Rock, Texas. In some levels of the terrace, burnt-out hearth fires and kitchen refuse of the ancient Texans have also been detected.

The significance of the discovery is that the time scale of America's vague prehistory must be stretched to a greater length, like an elastic band. For if the river terrace flints are as old as the geology proclaims them to be, they are still not so old in type as some other Texas relics of man. Hence, the older relics must be given a new status, as having a much greater antiquity than has heretofore been assigned them. The latest Texas find may, or may not, go back to the Ice Age. According to Professor Sellards, "The find is of the first order of importance in that it clearly demonstrates the fact that man was living here, not sparsely, but in numbers during the time when our broad valleys were being carved and filled by normal stream action."

Referring to scientific doubts and arguments over many reported discoveries of early Americans, Professor Sellards commented: "One beautiful feature of the situation lies in the abundance and unmistakable character of the archeological materials. A few minutes digging at the right place brings to light chips and artifacts to such effects as to settle at once all doubts as to the archeological facts. Formerly it was supposed that man first appeared in North America from 8,000 to 10,000 years ago. The recent discovery at Round Rock by Mr. Pearce and similar discoveries elsewhere are tending to place the time of the appearance of man on this continent from 10,000 to 20,000 years earlier."

HIGH-ALTITUDE FLYING

HIGH-ALTITUDE flying is the only apparent way of reaching the high cruising speeds demanded of present passenger aviation and at the same time obtain economical operation, according to W. Bailey Oswald, of the

Douglas Aircraft Company writing in the *Journal of the Aeronautical Sciences*.

The future promises high-speed flying at altitudes up to 40,000 feet with costs equal to or less than those of present-day low-altitude flights, predicts Mr. Oswald.

In his extensive report showing that high-altitude flights are sound both from the engineering and economy sides, Mr. Oswald indicates that by using the newest type planes with superchargers and variable pitch propellers it is possible to obtain a 69 per cent. increase in cruising speed with an increase of only 6 per cent. in operating costs. This high ratio of speed gain to operating cost increase is possible for planes cruising at 40,000 feet.

Superchargers, compressing the rarefied air of stratospheric heights to densities usable by motors and passengers alike, is the key to high-altitude flying, reports Mr. Oswald. The capacity of present superchargers need only be increased some 15 per cent. to make possible flights at 40,000 feet. Such equipment will serve adequately the engines and at the same time will give a sufficient supply of air to passengers and pilots. In fact, he indicated, once the problem of supercharging a motor at 40,000 feet is solved the problem of passenger oxygen supply will be solved also.

Even the heating of the air from its average temperature of 55 degrees below zero will be taken care of, for the compressing of the atmosphere automatically warms it up to temperatures as high as 300 degrees.

When airlines use a high-altitude, ten-hour flying schedule from New York City to Los Angeles, the cost per passenger may be as low as \$100. A fare of \$125 to the passenger would make such a problem economically sound, he says.

Discussing high-altitude flying from the passenger's viewpoint, Mr. Oswald said, "In high-altitude flying some passengers might find the darkened sky and reduced visibility of the earth objectionable; but high-altitude flying must be regarded purely as a means of transportation. Sightseeing will have to be done at low altitude with all the attendant evils."

High flying makes for safer flying, Mr. Oswald reports, for from an altitude of 40,000 feet an airplane can glide 120 miles and take an hour to do it. It might even be possible, in many cases, for mechanics on the plane to make the necessary repairs during this hour of descent.

Flights at high altitudes are economically feasible for distances greater than 600 miles, the aviation authority reports. For shorter trips the plane would spend all its time gaining altitude and then descending. The result would only be about the same as a level flight at half the maximum altitude.

ITEMS

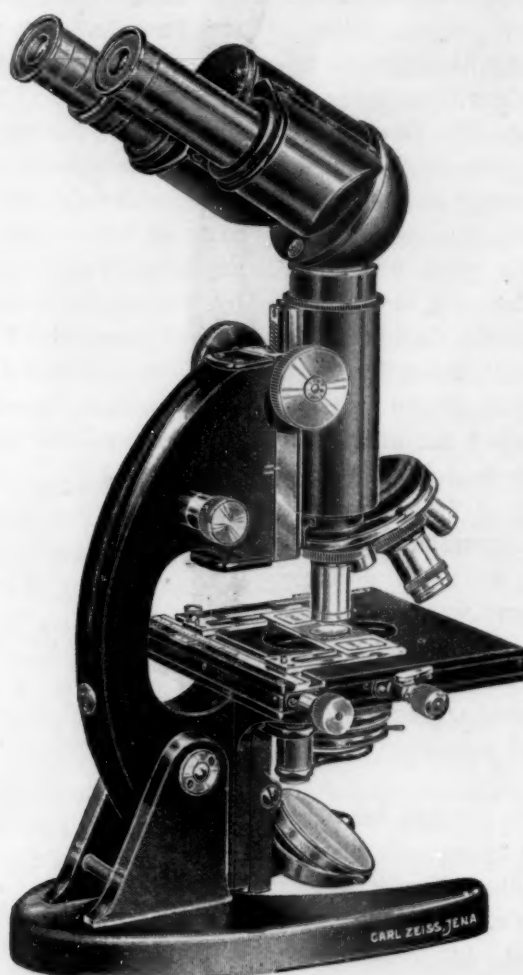
DUST storms, choking the air and blinding the sun, may come whirling out of the Northwest at any time, the U. S. Weather Bureau warns. The soil throughout the drier western part of the Great Plains region, from eastern Montana and the western Dakotas down to eastern Colorado and western Nebraska, is still in a state of unrelieved drought, and bare of any snow cover. A high wind, which is normally to be expected during late winter, will almost inevitably mean a dust storm.

LITTLE cradles that became coffins thirty million years ago have had the riddle of their tragedy read by Dr. Roland W. Brown, paleontologist of the U. S. Geological Survey. They had been unexplained ever since they were found four years ago by Dr. Charles W. Gilmore in Wyoming rock deposits of Eocene Age. They are small cylindrical white objects, some of them of solid limy substance, some of lime mixed with clay. First guesses made them anything from fossilized snake eggs to date seeds. But by tracing them down a number of geological and biological clues, Dr. Brown has reached the conclusion that they are the larval cases of ancient burrowing bees, in which infant insects were wrapped for the sleep that would transform them into full-grown winged forms.

A NEW source of radium has been discovered. Plans are now under way for the construction of a radium extraction plant on the island of Tcheleken in the Caspian Sea. Tests by the Institute for Rare Metals in Moscow show that water from wells on this isolated island contains up to a half milligram of radium for every 1,000 cubic meters of water. At current American prices of \$60,000 for a gram of radium some thirty dollars worth of the valuable radioactive element could be obtained from the volume of water in a tank twenty feet in diameter and ten feet wide. Pumping and extraction plants will be built on the island in 1935.

A STUDY of a combination of silver and electricity to preserve fruit juices such as cider and grape juice is being made by Lawrence H. James and E. A. Beavens, of the U. S. Bureau of Chemistry and Soils, and was reported to members of the Society of American Bacteriologists. The method is similar to the sterilization of water in swimming pools by the use of colloidal silver. A small electric current is passed through the solution, which forces the silver into the juice so that when enough silver is present, it delays fermentation of the fruit juices.

REAL sea serpents once swam in the offshore waters near the present site of the national capital. They were, apparently, at least as large as the biggest living land snakes. But they never scared anybody, or got stories about themselves in the papers, because they lived sixty million years ago, long before the first human beings appeared anywhere on earth. Evidence for the existence of these ancient sea monsters has been turned over to the Smithsonian Institution, in the shape of a single fossil vertebra, or backbone joint, picked up on Belvedere Beach, Va., by Dr. W. Gardner Lynn, of the Johns Hopkins University. By comparing this one bone with those of living serpents Dr. C. W. Gilmore, of the U. S. National Museum has been able to make an estimate of the size of the extinct sea serpent. He judges it to have been perhaps about twenty-five feet long, and thick in proportion. That is about as big as a really large modern python, of which this Virginia sea serpent may have been a remote cousin, though not an ancestor. Dr. Gilmore has named the monster *Paleophis virginianus*, which is Greco-Latin for "ancient Virginian serpent." It had some contemporaries almost as large as itself, two of which have been found in New Jersey and one in Alabama. They were all sea dwellers.



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SCIENCE NEWS

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SOME PAPERS READ AT THE PITTSBURGH MEETING OF THE AMERICAN ASSOCIATION

LIKE a careful contractor who removes a stone of doubtful strength from the foundations of a building, Professor Albert Einstein strengthened the basic foundations of his theory of special relativity in his address before a select group of four hundred and fifty mathematicians and physicists, taking his audience back to 1905. That was when his paper on the special theory of relativity appeared. At that time, he explained, it seemed necessary to use the concept that an electromagnetic field energy may be localized. Electromagnetic field may sound complicated, but it is the varying electromagnetic waves sent out by a broadcasting station which makes the radio sets in the homes of America operate. The concept that the energy in a magnetic field might be localized in various points in space, Professor Einstein said, has always been debatable among scientific men. One group felt that the idea was sound, the other believed it was not—but neither could prove its point. It is this unprovable doubtfulness which Professor Einstein feels is a weak link in his 1905 paper on relativity. In his address Professor Einstein gave a simple proof of the way energy is related to mass by the relation, energy equals mass times the square of the velocity of light, and he did it without using the doubtful electromagnetic field energy localization of his 1905 report. His simple proof depended only on the conservation of impulse when two similar bodies collide in the inelastic and elastic impact, and on the method of transforming coordinates in space developed by Lorentz. Professor Einstein's proof may be of historic interest, for text-books of physics in the future may contain it instead of the present more complicated proof. Such a situation has occurred before in other fields of physics.

DR. W. F. G. SWANN, of the Bartol Research Foundation, at the annual exhibit of the association reported his plans for apparatus to be carried on the ascent of the stratosphere balloon of the National Geographic Society. The set-up will be a new group of Geiger counters, similar to the group carried on the flight by Dr. and Mrs. Jean Piccard last summer, but incorporating certain improvements. The Piccard flight instruments, now historic, are part of the exhibit of the Bartol Research Foundation. Geiger counters are exceedingly sensitive electrical devices which register an electric "kick" when a ray or charged particle strikes a fine wire inside. If two of them are placed in line, and both of them register simultaneous "kick," it means that the same ray or particle has hit both wires, thus indicating that it came from the direction in which the two counters are aligned. The set-up for cosmic ray study consists of several such pairs, each pair aligned in a different direction, to catch rays from as many angles as possible. Dr. Swann stated that he is also considering sending up a "cloud chamber," coupled with his counter apparatus. A cloud cham-

ber is a device that makes visible the path of a charged particle by means of a fog trail of condensed water particles, which can be photographically recorded. As a matter of economy in film, Dr. Swann said that this cloud chamber would be hooked up to the counter group by suitable amplification, so that an exposure would be made only when the counters registered a "kick."

RIM speeds of almost 1,400 miles an hour, or 2,000 feet a second, have been attained by a new refinement of the super-centrifuge developed at the University of Virginia under the direction of Professor J. W. Beams. The new apparatus is turned by an air turbine similar to those already in use in his laboratory. This turbine consists of a top-shaped piece of metal with inclined vanes against which streams of high-pressure air are directed. The air stream lifts the turbine out of the cup in which it rests when still, spins it at high speed, and at the same time serves as a cushion on which the unit rides. At the high speeds the friction of air on the turbine becomes a matter of some importance, acting in brake fashion. For this reason, Professor Beams spins the "rotor" of the turbine in a vacuum. This is accomplished by suspending the rotor beneath the turbine on a slender piano wire. An air-tight box surrounds the rotor into which the wire passes through a tiny hole. Viscous oil fed into the hole lubricates it and at the same time seals it against the air. The box, thus sealed, is evacuated of practically all its contained air, and the rotor spins in a vacuum. Speeds attainable by the rotor are limited only by the strength of its own material. One experimental rotor, made of solid duralumin, was exploded by its own centrifugal force when it reached a speed of over 132,000 revolutions a minute. The portions of metal at its edge were experiencing forces of about 900,000 times gravity. If the total energy of spin could have been utilized in lifting the rotor against the pull of gravity, it would have raised it to a height of five miles.

SCIENCE has recovered thousands of dollars of valuable radioactive products from which gamma rays, so useful in cancer therapy, may be obtained. Professor George B. Pegram and Dr. John R. Dunning, of Columbia University, reported that the heavy ray-producing element polonium had been recovered from old radon tubes obtained from Memorial Hospital in New York City. In one test polonium equivalent to \$2,100 was obtained by the new method. Polonium is the radioactive element discovered by the late Madame Curie, who, with her husband, also discovered radium. The scientific method consists essentially of separating the polonium from impurities by use of electric current in a solution. An every-day use of this electrolytic technique is in the silver plating of metal, like knives, forks and spoons. Using a variation of the common method developed by the electrochemist Professor Colin Fink, of Columbia University, Professor Pegram and Dr. Dunning employed

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a rotating electric contact in their polonium-bearing solution. Revolving at speeds as high as 6,000 revolutions each minute the rim of the electrode moved with velocities up to thirty-six feet a second. In a sample extraction test 35 millicuries of polonium were obtained. A millicurie is the unit by which the amount of radioactive materials is measured. A gram of radium, worth \$60,000, is equal to 1,000 millicuries. By obtaining thirty-five millicuries, polonium worth \$2,100 was recovered.

CELESTIAL twins, a pair of giant "suns" revolving round and round each other millions upon millions of miles out in space, are revealing to astronomers secrets of star composition never before known for any other stellar object in the whole universe outside of our own sun. In three papers by Drs. W. H. Christie and O. C. Wilson, of the Mount Wilson Observatory; Dr. P. T. Oosterhoff, also of Mount Wilson Observatory, and Dr. Frank C. Jordan, of the Allegheny Observatory, the new discoveries about Zeta Aurigae were disclosed. An analysis of the outer vaporous chromosphere starlight shows that atoms of iron, nickel, titanium and aluminum are present. Light hydrogen gas was also found, plus atoms of calcium and titanium in an ionized state wherein a charge of electricity—an electron—had been stripped from them. The year 1934 has been an especially fortunate one for observing the eclipses of Zeta Aurigae, for only three times in eight years do eclipses occur. "At these times," explained Drs. Christie and Wilson, "the small hot star is passing behind the extended, tenuous atmosphere of the large one. As a result the spectrum of the smaller star shows the absorption lines due to the atoms composing these portions of the atmosphere of the larger one lying in the line of sight." By analyzing these spectral lines astronomers are able not only to tell what kind of atoms are to be found in the outer layers of the big star, but have indications about the heights at which the various kinds of atoms may be found.

MAN had nothing to do with the making of the recent drought in the West, any more than with the earlier period of abundant rains from 1900 to 1915, though he has been given blame for the one and credit for the other. J. B. Kincer, of the U. S. Weather Bureau, speaking before the meeting of the American Meteorological Society, said that during the years of abundant rain and expanding agriculture in the West, the belief that planting crops "made rain" became so general that the Weather Bureau called upon him to prepare an essay showing its erroneousness, which received wide publication. Now that the climatic pendulum has swung to the other extreme, he again found it necessary to combat the opposite error. He minimized the idea that the drainage of many small lakes and extensive marshes helped to cause the drought by "robbing the air of its moisture." Though on the surface an attractive theory, a little examination of the magnitude of the physical factors involved in weather quickly shows that the changes in surface water made by man are relatively insignificant. "But," the speaker continued, "man has contributed

very materially to the damaging effect of the Great Plains drought, through extensive cultivation where it never should have been practised. This has intensified the drifting of soil and contributed to severe dust storms which were important unfavorable features of the recent drought. The remedy here is fewer cultivated fields; more natural vegetation; more grass lands without too close grazing, and any device that would diminish the surface velocity of the wind and conserve soil moisture. In such things as these he is not helpless."

DENTAL decay is beginning its attack at an earlier and earlier age. About half the two-year-old children in large cities have at least one cavity in their teeth, according to Dr. John Oppie McCall, director of the Guggenheim Dental Clinic, New York City. Dr. McCall likened the present-day search for the cause and means of preventing dental decay to the old search for the Philosopher's Stone. To draw this parallel is more than mere fancy, he said. No one will deny that health is more valuable than wealth and it is not difficult to demonstrate that uncurbed dental decay is a common, perhaps invariable cause of ill health. The wide spread of dental decay in the population is well known, over 95 per cent. being involved. The search for the Touchstone of Prevention has long been under way, antedating even the search for the alchemists' Elixir. The importance of diet in preventing and controlling dental caries is known, but investigators do not yet know how the foods and food factors like vitamins which have been found helpful do their part. Neither is it known which elements in the diet are of prime importance and which of only secondary importance. The various elements in the situation which have been the subject of careful study are the influence of vitamins A, D, C, mineral balance, sugar intake, acid-base balance and raw foods. Dr. McCall urged the co-operation of physicians, bacteriologists, nutritionists and dentists in attacking this fundamental problem.

ACCURATE and almost instantaneous recording of rapid changes in temperature, humidity and barometric pressure during airplane flights for gathering weather forecast data is possible with the use of an improved type of meteorograph which has been developed in the division of meteorology at the Massachusetts Institute of Technology. Streamlined to minimize air resistance and thus avoid lowering the "ceiling" of light airplanes, the instrument is extremely sensitive, eliminating the lag in recording behind true conditions which is experienced with old type meteorographs. Enclosed in an aluminum case and resembling in appearance a tiny Zeppelin, the instrument is only three inches in diameter and about fourteen inches long. It is suspended from the wing of an airplane in a specially designed frame, making its recordings by means of minute tracings on an inch-square piece of smoked glass. The design of the instrument, following the principle of the Jaumotte sounding balloon meteorographs used by the institute, combines sturdiness, streamlining and great sensitivity. Due to the high-rate of climb of modern airplanes, the temperature and humidities to be continuously recorded by the meteorograph

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change very rapidly. If the thermometer and hygrometer are not sufficiently sensitive, their indications lag and can not be used when exact measurements are required. The only way to obtain reliable data from the old type meteorographs was to climb slowly, an unsatisfactory solution. To increase sensitivity a bimetal thermometer one two-hundredth of an inch thick and suitable for use in the fastest climbing planes was employed. The traditional human hair in the hygrometer for recording humidity was also used. The new instrument has been tested on the meteorological research plane of the institute for three weeks with excellent results.

THE tiny hearts, or nuclei, of atoms which science can study only by breaking them apart in atomic bombardment experiments are really "atoms within atoms," according to Professor David R. Inglis, of the University of Pittsburgh. Professor Inglis's "atom within the atom" statement is based on mathematical studies which interpret the magnetic properties of the nucleus in good agreement with observed experimental data. The atom consists, Professor Inglis explained, of the nucleus with many electrons gyrating about it in such a way that the atom may have quite strong magnetic properties, and the correct theory of the motion of these electrons has been recognized by its success in explaining the observed magnetic properties of the atom. The story is repeated inside the nucleus, and the laws of motion of the particles in the nucleus are recognized by explaining the magnetic properties of the nucleus. It is shown that the nucleus actually seems to be a tiny and intricate atom within an atom.

A POTENT factor in the survival of human and other animal races is the mechanism the body has built up for defending itself against invading disease germs. How this mechanism works was described by Dr. Reuben L. Kahn, of the University of Michigan. Dr. Kahn's research on this subject won him the annual award of the association last year. The defense mechanism is most active in the outer ramparts of the body, the skin and mucous membrane lining nose and mouth, because through the ages these tissues have been first to make contact with micro-organisms. Dr. Kahn found that when "germs" enter the body, this first line of defense in skin or mucous membrane promptly rallies to the attack and anchors the invading germs at the point of entry, trying in this way to prevent their penetrating further into the body. Once the harmful germs are anchored, other forces of the body destroy the invaders. A second line of defense has been built up in the blood stream. According to Dr. Kahn the state of being immune to a disease, or able to resist infection, is therefore a defensive state. This defense mechanism operates against other foreign invaders besides germs. Among these are certain pollens, wool, fur and certain foods. Hayfever resulting from exposure to the pollen of ragweed, for example, is not a state of over-sensitiveness, but of over-defensiveness. The defense mechanism may not be sufficiently active to cope with certain micro-

ganisms, in which case disease results. Or it may be overactive to such a degree that exaggerated local and general responses will result from tiny amounts of the foreign invader.

ORCHIDS, flowers of wealth and luxury, demand luxurious infant food, experiments by Dr. Lewis Knudson, of Cornell University, have shown. He told an audience of plant physiologists how he has been able to grow orchid plants from seed, if he provides the seed with sugar. Otherwise they will not sprout. It was thought for a long time, before Dr. Knudson demonstrated otherwise, that orchids could not be grown at all without the fungi always found swathing their roots in a state of nature. Dr. Knudson also reported some curious effects on the growth of ferns when their spores, or one-celled propagating bodies, are treated with x-rays. The young stages of the fern plant that spring from such irradiated spores have abnormally large chloroplasts, or chlorophyll-bodies within the cells. At first these are irregular, then they assume the normal round shape, but are still several times the size of ordinary chloroplasts. Two full-grown ferns which he has succeeded in growing from an x-rayed start still have the abnormal chlorophyll bodies.

SUGAR cane makes glucose and its related "reducing sugars" on sunny days before it forms cane sugar and starch, as reported by Dr. Constance E. Hartt, Hawaiian plant physiologist. Dr. Hartt is working on sugar-cane problems for the Hawaiian Sugar Planters' Association. In the experiments, samples of cane leaf blades and sheaths were gathered at one-hour and two-hour intervals over periods of twenty-four hours, and analyzed for the various kinds of sugars they contained. Reducing sugars, like glucose, were at their maximum when the sunlight became strongest, but as afternoon progressed their concentration fell off. On the contrary, the cane-sugar and starch contents of the leaves continued to increase until nightfall. This is interpreted to mean that the cane-sugar and starch are formed from the reducing sugars, which is in accordance with the usually accepted plant physiological theory. However, during the hours of strongest sunlight, reducing sugars are formed faster than the plant can change them into cane sugar or sucrose. Dr. Hartt also reported another study on the activity of the enzyme known as invertase, in converting glucose into cane sugar in the leaves of the plant.

PROFESSOR WILLIAM K. GREGORY, of Columbia University and the American Museum of Natural History, reported on the evolution of the pelvis, or girdle of bone that supports the hips, all the way from fish to man. The first pelvis was an exceedingly simple affair, according to Professor Gregory. It consisted simply of a couple of flat rods of bone, not attached in any way to the spine, which helped to support the rearmost pair of fins in fishes. When animals left the water and came ashore as amphibians, the pelvis became considerably more elaborated. It was "like a broad triangle surmounted by a short-stemmed, lop-sided Y." From these humble beginnings, the bony support of the hind legs has become progres-

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ROBERT S. HARRIS and JOHN W. M. BUNKER. The phytin phosphorus of the corn component of a rachitogenic diet. One figure.

JOHN C. KRANTZ, JR. and C. JELLEFF CARR. A statistical study of the metabolism of the fasting albino rat. One figure.

SAMUEL H. BASSETT. Mineral exchanges of man. V. Balances of electrolytes in a case of hyperparathyroidism. Five figures.

SAMUEL H. BASSETT and HELEN VAN ALSTINE. Mineral exchanges of man. VI. The effect of extirpation of a parathyroid tumor on the balances of electrolytes. Four figures.

E. H. HUGHES and H. G. HART. Production and composition of sow's milk.

ALAN C. BURTON. Human calorimetry. II. The average temperature of the tissues of the body. Three figures.

ALAN C. BURTON and JOHN R. MURLIN. Human calorimetry. III. Temperature distribution, blood flow and heat storage in the body in basal condition and after ingestion of food. Four figures.

A. F. MORGAN, L. KIMMEL, A. FIELD and P. F. NICHOLS. The vitamin content of Sultanina (Thompson Seedless) grapes and raisins.

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sively more and more solid, first enabling animals to progress freely upon all fours with body clear of the ground, and finally, in erect-walking humanity, carrying much of the weight of the internal organs, and freeing the front limbs to become arms.

SOYBEAN plants deprived of sulphur in the soil get sick, and show it by turning yellow-green, and producing smaller leaves and thinner stems. These external symptoms, and an analysis of internal derangements due to the lack of sulphur, were described by Dr. Scott V. Eaton, of the University of Chicago. The external symptoms are similar to those caused by lack of other elements, such as potassium, phosphorus and calcium. Dr. Eaton explained that starvation in these necessary minerals interferes with the formation of one of the plant's indispensable enzymes, reductase, thereby preventing the plant from making use of nitrates, necessary for the formation of protein foods and the upkeep of its living protoplasm. Stopped from this normal nutritional function, the plant piles up soluble nitrates and organic nitrogen compounds, as well as all forms of carbohydrates. Sulphur starvation thus apparently works its harm through causing starvation in other, quantitatively more important, elements in the plant's life cycle.

LONDON fog is largely made by London hearth-fires. All cities that gloom along through dim-sunned winters have themselves to blame, to a very large extent. Minute particles of ash and soot go up through their chimneys in smoke. These tiny solid particles in the air, with others from other sources, serve as "nuclei" for the condensation of water vapor and the formation of cloud, fog and mist droplets, and eventually for raindrops and snowflakes. Such condensation nuclei, according to Dr. Helmut Landsberg, of Pennsylvania State College, double their numbers as soon as chill weather comes on in the fall and more fires are lighted. Dr. Landsberg based his conclusions on over a thousand observations of air conditions. Seven hundred of these were made on a mountain in Germany, a few over the North Atlantic Ocean, and the rest at State College, Pa. Over the ocean the nuclei are largely salt crystals, and their number is relatively low at most times. Migrating masses of air from Arctic regions are also low in nuclei counts, so that it is possible to tell with considerable accuracy the general source of a given air mass by counting the solid particles in it.

SHEEP in the Northwest developed a highly destructive epidemic of tularemia or "rabbit fever" last spring, which Dr. Cornelius B. Philip, U. S. Public Health Service, reports was borne by the parasitic ticks common on the range. Corroborative evidence included the death of many jackrabbits from tularemia at the same time, the discovery of tularemia bacteria in the bodies of some of the ticks, a case of tick-transmitted human tularemia, and bacteriological tests on the blood sera of diseased sheep. Dr. Philip had as associates in the research William L. Jellison, of the Rocky Mountain Spotted Fever Laboratory of the U. S. Public Health Service, and H. F. Wilkins, of the Montana Livestock Sanitary Board.

SOMETHING very much like hibernation, or the almost death-like sleep in which certain animals rest for parts of their lives, can be produced by heavy water, containing the recently discovered double-weight hydrogen atoms. Experiments indicating this were reported by Dr. T. Cunliffe Barnes and E. J. Larson, of Yale University. Dr. Barnes and Mr. Larson used flatworms, a relatively primitive life-form, in their investigations. Flatworms kept for months in a dilute solution of heavy water in ordinary water were still the same size as they had been at the start. Other flatworms, kept in pure ordinary water as "controls," had lost four fifths of their size after the same period. Slower chemical reactions of digestion, and slower life-processes generally, indicated the "sleepiness" of the animals in the heavy water solution.

DRIED stocks of living bacteria needed for later study can be kept conveniently and at low cost. How the technique of drying out certain bacterial types and still keeping them alive can be applied to the species that thrive only when they are not exposed to the air was described before a medical audience by Dr. Alden F. Roe, of the George Washington School of Medicine. The bacteria are grown in suitable media until there is a considerable quantity of them. Then the fluid is centrifuged, to concentrate them. The concentrated suspension of bacteria is transferred to strips of filter paper, and drying is carried on rapidly in the cold, under vacuum. Then the strips are transferred into small sterile glass tubes, the air exhausted, and the tubes sealed until the bacteria are needed for experimental purposes. Bacteria of two botulinus types, as well as several other less harmful strains, have been alive and ready to resume growth after a year in vacuum-tube storage.

BEES are suffering from poison dusts spread from airplanes and intended for the destruction of harmful insects. The harm done by this wholesale spreading of insect poison by the rapid and cheap airplane method was described by Dr. J. E. Eckert and H. W. Allinger, of the University of California. The airplane dusting method, Dr. Eckert stated, is responsible for the reduction by a round million in the number of hives or colonies of honeybees in the United States during the past three decades. The bees are not always, perhaps not usually, affected by the poisoning of the flowers of the crop plants being protected by the dusting. The mischief is apparently more often caused by the drift of part of the deadly dust into the flowers where they are working. Bees gathering nectar are usually killed by the poison before they can reach the hive. Pollen-gathering bees, since they do not swallow their gleanings but carry it in hair-baskets on their legs and bodies, get home with the poisoned food and give it to the young bees in the brood, thus cutting off the increase of the colony at its source.

How far corn roots grow through the soil has been determined by a new method, described by Dr. J. D. Sayre and Dr. V. H. Morris, of the Ohio State Agricultural Experiment Station at Wooster, Ohio. The method

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depends upon the fact that the element lithium, rare in ordinary soils, can be taken up by plants without apparent injury, and afterwards can be made to show its presence by a peculiar red color when burned. In the tests, a quantity of lithium salts is mixed with earth, and a core of this "lithiated" earth is planted twelve to eighteen inches deep between corn rows after the last cultivation. After harvest, parts of the dried plants are burned in the laboratory, and the flame examined with the spectroscope. The plants showing the characteristic red line of lithium are assumed to have sent their roots into the "lithium spot" in the soil. The possibility that the lithium may have moved through the soil, in solution, is ruled out on the ground that "it enters into the base exchange complex of the soil.

CHRYSANTHEMUMS of a special kind are grown not for ornament but for the production of insect poison. Specifically, they are known as pyrethrum, and their extract, pyrethrin, is one of the most widely used means of chemical warfare against many insect pests. Dr. Brooks D. Drain and G. A. Shuey, of the University of Tennessee Agricultural Experiment Station, told how especially desirable strains of pyrethrum can be propagated without risking the loss of their valuable high poison content. The propagation consists simply in dividing the plants, much as ornamental chrysanthemums and other flowers of the same type are divided. If plants are grown from seed, the pyrethrin content is uncertain, but this vegetative propagation eliminates the risk of hybridizing with

low-grade pyrethrum strains. The best pyrethrums may contain as much as two per cent. pyrethrin, while poor plants have as low as 0.6 per cent.

THE popular belief that men are mentally superior to women, and that the number of extremely intelligent is greater among boys than among girls, was dispelled by a report by Professor Paul A. Witty, director of the psycho-educational clinic at Northwestern University. The popular misconception has been given support, Professor Witty pointed out, by observation of the outstanding proportional achievement of men in music, art, science and literature, and also by studies that have been previously made of small numbers of gifted children. It fails, however, when large numbers of boys and girls are studied with the unprejudiced eye of scientific mental measurement. Altogether, 14,149 boys and 13,493 girls, all students in secondary schools, were included in the study.

RAT fleas spread typhus fever in America, but they are not mere mechanical carriers. The virus of the disease multiplies in the body of the flea, according to a report by Dr. R. E. Dyer, of the U. S. Public Health Service's National Institute of Health. The investigation which disclosed how typhus fever is spread in this country has been carried on over a period of years by the federal health service. During the course of the investigations, a number of the men working on the problem contracted the disease.

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SCIENCE NEWS

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ELECTRICAL APPARATUS FOR BRAIN CENTERS

IMPROVED electrical apparatus for investigating the functions of deep brain centers and other remote nerve centers has been developed by Professor E. L. Chaffee, of Harvard University, and Dr. Richard U. Light, of the Yale Medical School.

Already in use in research at Yale, this improved method of investigation has been remarkably successful and holds promise of being of great importance in medical research, according to Professor Chaffee.

The new apparatus has the advantage of eliminating one of the principal faults of previous experiments involving the electrical excitation of an animal's nervous system, the necessity of connecting the subject to an electrical circuit by wires.

This method necessitated either anesthetizing the animal, thus suppressing many normal functions, or restraining the animal, thus interfering with normal reactions. The need of connecting the animal to an outside electrical source has been eliminated, thus allowing the animal to move freely and lead a normal life throughout the experiments.

There is no interference with the animal's regular habits of eating, sleeping, drinking and exercising, the subject suffers practically no discomfort at all and thus much more significant results are obtained.

The apparatus operates on the principle of induction, a small coil of wire, the secondary coil, being applied to any portion of the animal that the experimenter wishes to test. One end of this coil is attached to a platinum plate embedded in the animal's tissues. The other terminal is connected to a very thin platinum wire, insulated its entire length except for the very tip, which may be touched to any brain center or nervous tissue that is under investigation.

It is possible with this apparatus to confine the stimulus to a very small and accurately known region, and the tiny wound for insertion of the wire heals quickly and easily with no ill effects to the animal.

Electrical energy is supplied to the small secondary coil from an external or primary coil in either one of two ways. The simpler form is a single coil three or more feet in diameter, large enough to enclose the small cage in which the animal is to live.

The better form consists of three such coils mutually perpendicular to each other and enclosing a similar cage. This type of primary coil permits better control of the stimulus and therefore gives more accurate results. Variation of intensity in various parts of the cage is remarkably small.

The interpretation of experiments involving this apparatus must depend on the knowledge of the wave form, intensity and frequency of the stimulus. Professor Chaffee has developed the theory and experimental method which makes this possible, having first made certain measurements and certain assumptions as to the

electrical properties of the animal tissue through which the stimulus must be applied.

The apparatus was designed to allow controlled variation of intensity and frequency, and general control of wave form. The discharge through the three primary coils occurs in rotation, the frequency and switching operations being automatically controlled by vacuum tubes.

ALUM TREATMENT FOR ENCEPHALITIS

A NEW way of getting protection against infantile paralysis, encephalitis and similar diseases which invade the body through the lining membranes of the nose may result from studies just reported by Dr. Charles Armstrong, of the National Institute of Health of the U. S. Public Health Service.

It was in the course of these studies that Dr. Armstrong himself recently suffered an attack of encephalitis as a result of working with the infective virus for many months.

Dr. Armstrong reports that a three per cent. solution of sodium alum dropped once a week into the nostrils of white mice enabled these animals to resist nasal infection with the virus of encephalitis from the epidemic in St. Louis in 1933. This was because sodium alum of just that strength provided the right degree of irritation to make the nasal mucous membrane resistant to the encephalitis virus. Other strengths of sodium alum and other solutions, such as salt and sugar, were not as satisfactory.

In the beginning of his investigations the mice were given weekly doses of the alum solution for several weeks before giving an infective dose of encephalitis virus. It was thought that perhaps such astringent or mildly irritating treatment, if applied in the face of an epidemic or in the presence of the virus, might enhance susceptibility to infection.

Further investigation, however, showed that dropping the solution into the animal's nostrils just before or soon after the infective dose did not increase their susceptibility to infection, but might even lessen it. This point may be of significance in developing the method to give protection during epidemics.

Dr. Armstrong's work has not yet been given practical application, but reading between the lines of his scientific conclusions it appears that he believes it may pave the way for this in the future.

The experimental work here recorded therefore suggests lines of study which may possibly lead to the development of procedure of practical value in preventing infections contracted by way of the nasal mucous membranes.

Since not only encephalitis but the much-dreaded infantile paralysis is among the diseases that enter the body through the nasal membranes, Dr. Armstrong's research, if it develops practical value, will be of tremendous importance in man's fight against disease. The

latest research started from observations by himself and a number of other medical research men, that different substances could modify the local reaction to invading disease germs and viruses. That the effect is purely a local one was shown by the fact that mice that had had the nasal alum treatment were not able to resist the infective virus when it was injected into the brain instead of being introduced by way of the nostrils.

DISEASES OF GAME ANIMALS

THE veterinarian's difficulty in diagnosing the illness of an animal that can not speak to tell him "where it hurts" is encountered in aggravated form by the biologist who undertakes to study the sicknesses of wild animals in their native woods and waters. Yet it is important to understand the diseases of wildlife, for epidemics among game animals and birds frequently kill off a larger proportion of the afflicted species than all guns and traps put together, and can readily undo in a single season all the work of years of careful conservation and propagation.

How an approach to a diagnosis of wildlife disease can be made was outlined before the meeting of the American Game Conference by Dr. J. E. Shillinger, of the U. S. Biological Survey.

Counting the pulse and taking the temperature, standard procedures of the physician and the veterinarian, are of little use to the student of wildlife diseases. Momentary states of excitement or fear, such as might be induced by the very approach or touch of a human being, so change a wild animal's pulse and even its temperature that such readings would be quite meaningless. The wildlife "doctor" must depend on other diagnostic signs.

The natural instincts of a wild animal or bird hinder his efforts still further, for it seems to be the habit of most wild creatures to simulate health as long as they are able to walk or fly at all. Only when they are very sick indeed do they betray their state by abnormal appearance or actions. And even when they begin to "look sick," there is still a baffling sameness about their symptoms, whatever the specific ailment may be—the same lacklustre appearance of fur or feathers, the same lassitude and "droopiness."

Yet there are at least some differences in appearance or behavior that may help the diagnosing biologist. Some illnesses, for example, may cause great muscular weakness without loss of appetite; lead poisoning is such a one. If animals die quickly, without much loss of flesh, suspicion may point at an acute infectious bacterial trouble.

However, even with the best efforts, it is frequently impossible to tell what ails a sick wildlife population until you can find some dead specimens and subject them to a minute and methodical postmortem examination, Dr. Shillinger reports. He gave detailed directions for making such examinations. With the knowledge gained from dead victims of a disease, steps may then be possible to better the lot of those yet living.

The Biological Survey is cooperating with the University of Minnesota in a wildlife disease survey of a sample game area. Results of a year of this work were reported

jointly by Dr. R. G. Green, of the University of Minnesota, and Dr. Shillinger.

ELECTRON TUBES USED IN ELECTRIC MOTORS

(By Science Service)

A NEW type of electric motor which is believed to be revolutionary was described before the meeting of the American Institute of Electrical Engineers by the Swedish-born electrical engineer, Dr. E. F. W. Alexanderson, who is consultant for the General Electric Company.

It can be "plugged in" right across the leads of a 2,300-volt circuit and start gently and easily and not burn up. It uses electron tubes to turn alternating current into direct current so that the motor, although it runs off a-c, has the characteristics of a variable speed d-c motor. Instead of being started with a special resistance device for controlling the current supplied to it, the new motor can start from the beginning at "full throttle." The starting of the motor can thus be made entirely automatic from a remote point miles away if desired.

At an experimental installation at Schenectady the motor used is of 400 horsepower. The motor in a household electric fan is seldom more than one quarter horsepower.

In describing the new application of electron tubes to the field of electric motors Dr. Alexanderson in his paper, presented with A. H. Mittag, of the General Electric Company, told how the thyatron tubes employed take the place of the commutator in the usual motor.

A commutator consists of the copper segments at the end of the rotating part of an electric motor. Brushes, usually of carbon, bear against it and pass current through the rotor in the proper way. The make and break of such arrangement finally leads to sparking at the brushes, which requires a cleaning of the commutator and a reshaping of the brushes. With the electron tube commutator device such hindrances are avoided.

The new motor has a stationary armature and a revolving field of the type used in synchronous motors. The armature, however, is provided with a special winding. Unidirectional current is supplied by means of a group of full-wave rectifying thyatron tubes which operate from the three-phase 60-cycle current source.

The operation of the thyatron rectifiers is controlled by means of grids in these tubes so that power is supplied to the motor windings in the proper sequence and amount necessary to give the required torque for operation.

BACTERIA ON DRINKING GLASSES

AS many as 50,000 to 100,000 bacteria on a single glass were discovered by Professor W. L. Mallmann and E. D. Devereux, of the Michigan State College.

The investigation covers the sanitary condition of glasses at roadhouses, taverns, and saloons in cooperation with the Lansing department of health.

The possible rôle of eating utensils as a factor in the transmission of disease has been demonstrated from time to time over a period of years, they reported to the So-

ciety of American Bacteriologists. Tableware has been shown to be a carrier of the organisms causing diphtheria, pneumonia and tuberculosis and of two kinds of dangerous streptococcus germs.

Since the repeal of prohibition there have sprung up numerous roadhouses, taverns and saloons for the dispensing of alcoholic beverages. Many of these places are inadequately equipped with means of cleaning and sterilizing glassware. In many places not even running water is available, to say nothing of hot water. As a result various methods of cleaning and sterilizing glassware have developed, many of which are extremely questionable.

The investigation was started some months after a local health ordinance had gone into effect requiring the use of a chlorine rinse containing 200 parts per million of chlorine as a sterilizing agent for beverage glasses. Professor Mallmann and Mr. Devereux examined both the rinses being used and the glasses. Clean and dirty glasses were tested by swabbing the rims to a depth of half an inch on the inside and outside.

Few of the glasses were entirely free of germs, and as many as 50,000 to 100,000 bacteria were found on some. In most cases, there were more bacteria found on the rims of the clean glasses than the dirty ones. This, Professor Mallmann explained, is because the bacteria are washed off into the beverage in the glass. Nevertheless many of the dirty glasses and some of the clean ones had streptococci on their rims.

As a result of their investigation, they recommended certain provisions for sterilization of glasses. These included preliminary rinsing of the glasses to remove all beverage or other material, immersion for at least five minutes in the chlorine rinse or shorter immersion followed by five minutes draining without running off the chlorine water, and then a final rinsing in clean ice water or running tap water.

After these recommendations were made effective by the local health department, a number of places were revisited and the condition of the glassware was found improved.

COSMIC RADIATION FROM ERUPTING STARS

EXPLODING stars as the birthplace of the powerful cosmic rays are suggested by Professor Werner Kolhoerster's researches reported from Germany.

It is not a new idea that more cosmic rays come from the spectacular erupting star in the constellation of Hercules than from the rest of the sky.

Dr. Fritz Zwicky, of the California Institute of Technology, a few months ago put forth the idea that cosmic rays are let loose when a gigantic stellar explosion occurs, but he has felt that even the new Hercules nova, seen since December as a brilliant star near Vega, was too feeble to give many cosmic rays.

Professor Kolhoerster has found that when he pointed his cosmic ray counters directly at Nova Hercules during its recent eruption the cosmic ray intensity increased as the star grew brighter and brighter. An article published in the *Berliner Tageblatt* states the cosmic ray in-

tensity increased from one to two per cent. as he sighted his cosmic ray "telescope" at the star.

Hitherto observers have found no increase in ray intensity as they pointed their instruments at the sun or other stars in the sky; a finding which has led to the belief that cosmic rays come from interstellar space. Professor Kolhoerster's discovery, if confirmed, suggests that these past researches were not timed properly; that the special nova type star is the one which needs watching.

ITEMS

SUDDEN heart attacks, often masked under the name of "acute indigestion" and generally very alarming, are not so often fatal, it appears from investigations reported by Dr. Louis Faugeres Bishop and Dr. Louis Faugeres Bishop, Jr., who pointed out that recovery has been proved to be more frequent by far than formerly supposed. The circulation of blood in the heart muscle itself is the factor involved in many serious heart attacks, a fact which is gaining recognition, they emphasized. The increasing importance of this type of heart disease is widely recognized by insurance companies. A scientific instrument known as the electrocardiograph is of great value in detecting it.

SEISMOGRAPHS, instruments whose normal function is the measurement of distant shakings of the earth's crust, can also be used to detect local tiltings so slight as to escape the most precise measurements by surveying methods. Professor John P. Delaney, of Canisius College, told of using one of his exceedingly sensitive seismographs for the purpose of studying ground tilt toward the southwest in the region around Buffalo, N. Y.

FIGURES for pneumonia deaths per 100,000 of the population during the last few years have surprised health experts. Something apparently has happened to the affinity between pneumonia and influenza death rates. High death rates for these two diseases usually go together, but during the year just ended and also during the year 1932, the picture was reversed, according to statisticians of the Metropolitan Life Insurance Company. In 1934, reports from all over the country showed the fewest number of influenza cases in many years and the influenza mortality rate among the insurance company's industrial policy holders was half that of the previous year. Contrary to expectation, however, there was a pronounced increase in the pneumonia death rate. On the other hand, 1932 began with an influenza epidemic and closed with the lowest pneumonia death rate on record up to that time.

THE uneasy sea bottom off the Aleutian Islands, one of the most active earthquake regions of the world, took another shaking early on Wednesday morning, January 23, when at 2:24.1 A. M., eastern standard time, a severe quake took place. Seismologists of the U. S. Coast and Geodetic Survey gave the epicenter location as latitude 51 degrees north, longitude 168 degrees west. This is approximately 130 miles south of Unalaska Island.



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SCIENCE NEWS

Science Service, Washington, D. C.

MALARIA IN CEYLON

MALARIA, which has swept disastrously across Ceylon, is still a mystery disease to the U. S. Public Health Service. The emphasis on the green color of the causal parasitic cells appears to be the distinguishing characteristic that would set it up as a quite new malarial species.

The three well-recognized species of malaria germs already known also have pigments; but two of them are described as dark brown to black, and the third as light brown. The darkest of them, the species causing the quartan or "four-day" type of malarial fever, is described by some observers as "greenish." Dr. L. R. Williams, of the U. S. Public Health Service, states that if the British medical men on the island, who are exceedingly competent in the malarial field, describe the present form as green, it is not likely that they are confusing it with any of the already known species.

All forms of malaria are caused by one-celled animal parasites, of the genus known to scientists as *Plasmodium*. There are three well-recognized species, and a number of varieties of less certain distinctness. Of the three known species, one causes quartan fever, one tertian fever, and one a most virulent type of tertian or three-day fever which, because of its seasonal nature, is called aestivo-autumnal, or summer-and-fall fever. The parasites causing all malarias pass through a most complicated life cycle, partly in the body of the human victim, partly in that of the carrier mosquito. In the human blood they attack the corpuscles, breaking them down as they themselves multiply. Because of this peculiarity, the most marked of the many disagreeable effects of malaria are seen in the blood itself and in the organs where blood plays an important rôle, especially the spleen, the liver and the red marrow in the spongy parts of the bones. In the especially vicious attacks of pernicious malaria that end in death, it is often found that so many of the red blood corpuscles are broken down that the tiny capillaries are choked with their debris. In other cases, death seems to result from simple massive poisoning from a toxin secreted by the parasites.

The present terrific epidemic in Ceylon is not without precedent in that part of the world. In the Punjab, in northern India, more or less localized epidemics break out at intervals of a few years, seldom occurring twice in the same region. In these epidemics it is not uncommon for sixty-five per cent. of the population in the affected area to be attacked; and of the sick, sometimes a third or more will die. This is much more severe, though less extensive, than the present Ceylon epidemic where, according to cabled press reports, about a sixth of the total population are sick, with a death list representing only one in a hundred of those actually sick.

GIANT MOLECULES

EGG-SHAPED molecules so large that they may be seen with a microscope, the first time any molecule has been seen with such apparatus, have been discovered at Urbana,

Illinois, in the x-ray laboratory of the University of Illinois.

A molecule is the smallest subdivision of a chemical compound as it is known to man, in which its chemical properties are maintained.

Scientists are hailing the new find as the foundation for a really successful synthetic rubber. It is believed present-day synthetic rubber-like products have been made erroneously on the basis that rubber molecules each weighed 68,000 times as much as a hydrogen atom.

The new super-giants of the molecular world weigh 500,000 times as much as hydrogen atoms; over seven times as large as previous estimates of rubber molecules.

Yet the new giants are just at the limits of the microscope. They are but six one-hundred-thousandths of an inch long.

Professor George L. Clark, of the chemistry staff and pioneer in industrial x-ray work, made the discovery of the giant molecules. Their presence had been indicated by observing the fashion in which they bent, or diffracted, x-rays but only now have they been isolated for microscopic observation.

Botanists have known for years that the basic structure of cellulose and plant products consisted of little crystalline particles linked endwise. These structures could be seen in a microscope and were made up of the giant molecules.

The reason for failure of science to see the actual molecules before was that they were embedded in a jelly-like substance which had not previously yielded to any breaking-down process.

The value of the new discovery for rubber-making in laboratories lies in the fact that no substance can be man-made until its exact molecular weight is known and used in the manufacture.

From the discoveries of Professor Clark it appears, therefore, that rubber chemists need to make a rubber molecule nearly eight times as large as those with which they have been working.

Man-made molecules of such enormous size have not yet been produced in the laboratories. Few people even suspected that such large molecules could exist. Professor Clark's work shows that in plants these giants are possible. Research is expected to complete the final laboratory step to make them artificially.

CAUSES OF DEAFNESS

LONG exposure to loud noise, such as boilermakers experience in the course of their work, causes deafness by damaging part of the hearing apparatus, known as the organ of Corti. Strangely, however, the part of the organ most damaged by loud high-pitched tones is not the part which picks up faint sounds of that pitch, a group of investigators at Harvard University and Clark University have found.

The investigation which gives new knowledge both of a cause of deafness and of the little understood mechanics

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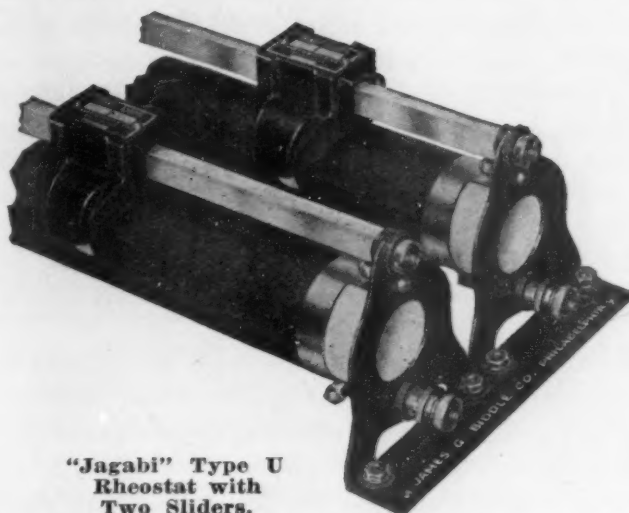
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of hearing was made by Dr. Hallowell Davis, Dr. Moses H. Lurie, Dr. Morgan Upton and Dr. Arthur J. Derbyshire, of Harvard, and Dr. Edward H. Kemp, of Clark University.

The intensity of the sounds necessary to damage is sufficient to cause definite discomfort in the ears of a human listener and to cause his ears to ring afterwards. It might be compared to that of a steam whistle or riveter at a distance of a few feet. The power of such tones in physical terms is some 10,000,000,000 times that of the faintest corresponding tones which the human ear can hear.

Because cats and guinea-pigs could not tell the scientists just when they stopped hearing tones, the electrical currents generated in their hearing apparatus were tapped something as a telephone conversation is tapped by a line-man splicing a wire from the phone line to his earpiece. In the case of the cats and guinea-pigs, the organ of hearing was connected to an apparatus which amplified the currents originating in it and carried these to a cathode ray oscillograph which wrote in light on a fluorescent screen a wavy line corresponding to the fluctuations in the current from the ear.

The sensitivity to sound intensity of normal cats and guinea-pigs as determined in this way corresponds quite closely to the normal human audibility curve, the investigators found.

The cats and guinea-pigs were exposed to sound of varying degrees of loudness for varying lengths of time. With the electrical set-up, the point at which they lost sensitivity to the sound and could not hear the tones was determined in each case. As a check, the tissues of their hearing apparatus were then examined under the microscope for signs of damage.

The results indicate that frequency of a tone as well as its intensity may be an important factor in determining whether or not it will damage the inner ear, it was reported, the tone of 2,500 cycles per second (about an octave above high C) being more effective than 600 cycles per second (a tone and a half above middle C).

Considerable individual differences in susceptibility were also indicated. Intense exposure may sometimes cause extensive damage to the inner ear and correspondingly great loss of hearing, it appeared. Some of the cases in which the damage was moderate and localized gave information suggesting that a certain part of the hearing apparatus picks up tones of a certain range in pitch, thus shedding light on a highly complex problem which has not yet been satisfactorily settled.

CARRIERS OF MENINGITIS

WHILE epidemic meningitis is a relatively rare disease, it has been fairly prevalent all over the United States during the past few years. It is known to public health authorities as one of the seasonal diseases, which means that it is more prevalent at some times of the year than at others. In the temperate zone, in which we live, it is most prevalent during winter and spring, reaching a high point in March.

Meningitis is an inflammation of the membranes covering the brain and spinal cord. This inflammation may

be caused by various types of infection, such as tuberculosis, pneumonia, streptococcus, etc. The type known as epidemic meningitis is caused by an organism called the meningococcus.

Epidemic meningitis is spread chiefly by healthy carriers who carry the meningococci in their throats and noses. Theoretically, the way to check meningitis would be by isolating all the carriers. This was found to be impossible during the World War, when the disease broke out among the soldiers, because the germ may be carried by one person to-day and by another to-morrow.

For example, if a thousand people are examined, probably about 5 to 20 per cent. of them will be found to be meningitis carriers. Examination of the same thousand people on the next day will disclose that five per cent. are still carriers, but the group of carriers may be composed of entirely different individuals. And the same will be true the next day, which illustrates the futility of trying to identify and isolate the carriers.

Sometimes a patient suffering from the disease gives it to others. This must be guarded against by isolating the patient and disinfecting all discharges from the nose and mouth, and the bedding, linen, etc.

Crowded living conditions, such as exist in tenements, in barracks during war time, or sometimes in the steerage of ships, are particularly favorable to the development of epidemics of meningitis.

A serum has been developed for treating meningitis which has been partially successful. This has been on the market for some fifteen years, but because of the irregular results obtained with it, the U. S. National Institute of Health is now engaged in investigations which it is hoped will lead to a more satisfactory product.

The meningitis serum is made from the blood of horses which have been inoculated with the meningococcus. The U. S. National Institute of Health has been collecting different strains of the germ from all over this country and from Europe. At present the Institute laboratory has over 300 living cultures. Most benefit is obtained when the serum is used early. For this reason prompt recognition of the disease is important.

Examination of the fluid within the spinal cord for the presence of the germ is the only way of making an absolute diagnosis of epidemic meningitis. For this purpose the fluid is drawn through a needle. The operation is not dangerous and does not cause much pain. The serum is later injected into the spinal cord, so that it will quickly reach the affected tissues.

ELECTRICAL SOUND RECORDING

A SYSTEM of electrical sound recording has been devised by Professor Vladimir Karapetoff, of the department of electrical engineering of Cornell University. His device makes it possible for a single performer to produce the effects generally achieved by a number of players. Each instrumental part is recorded electrically on a separate record. These records are then synchronized into one composite recording. The final record produces the effect of a complete orchestral group. Or one part may be cut out which the operator can play himself.

The idea was conceived of using the electric phono-

graph as a "partner and adjunct" in actual performance by instrumentalists and vocalists, rather than as a substitute for home singing and playing.

To put this idea in actual operation, he has assembled in his residence in Ithaca an elaborate outfit for making high-grade phonograph records on cellulose acetate and has added attachments to an electric phonograph for reproducing these records in connection with playing a musical instrument.

The records of accompaniments were made by Professor Karapetoff himself, with the correct tempi, retards and accelerations, but without gradations of the volume of sound. This latter is controlled by a resistance operated by the performer's foot, or by a second person familiar with the piece. In this way dynamic accents are introduced at will and the accompaniment is made to sound differently, depending upon the soloist, his mood, and the acoustic conditions of the room. Such accompaniment can be made for any musical instrument, using the piano or any other desired instruments as the background.

BUFFALO GRASS

IN keeping with the national reform program is the endeavor to reestablish buffalo grass on the now unprofitable plowlands of the Great Plains region. It has been found that a cycle of drought will easily wipe out all the agricultural gains made by years of "boom" wheat farming, and that winds often double the ruin and make it permanent by whirling away the soil itself, after drought and the locust have eaten every green thing.

The old native vegetation of the short-grass country was dominated by buffalo grass, because of its importance in the diet of the great herds of bison that once covered the plains. Buffalo grass is highly resistant to drought, will stand all but the most extreme cold, and with its everlasting habit of sending out "runners" like those of a strawberry plant it keeps an uninterrupted year-after-year hold on the soil.

It is as good food for cattle as it once was for the native bison, and it can be made into handsome lawns and well-kept golf courses.

It does, however, need encouragement to reestablish itself where it has been plowed out. It was thought at first that if an abandoned field were just left alone the buffalo grass would reclaim it. But experience has shown that this will not take place fully in less than 20 or 30 years. Fortunately, its growth habits make it fairly easy to propagate. It will grow from seed and it will take hold as solid sheets of transplanted sod.

ITEMS

AN aluminum and sand filter that removes fluorine from water has been devised by Dr. S. P. Kramer, of Fort Thomas, Ky. Fluorine in drinking water is the cause of a dental disease known as mottled enamel. The condition has become so serious in the Southwest, where fluorine is frequently found in the water, that at least one town has changed its water supply and now obtains its drinking water from another source in order to protect the teeth of its inhabitants. At one time it was feared that the water impounded by Boulder Dam would

prove useless because of reports of the high fluorine content of the Colorado River tributaries. Dr. Kramer made a contact filter of river sand to which he added 2 per cent. by weight of powdered aluminum. He reported in a previous issue of the journal, *SCIENCE*, that this filter removes fluoride from a solution containing 30 parts per million of sodium fluoride.

A NEW aid for diagnosing cancer and other diseased conditions of the breast is a powerful "cold light" which enables physicians to see through the tissues and observe directly the tumors or other abnormalities. Clinical trial of the lamp has been made at the tumor clinic of the Michael Reese Hospital in Chicago under the direction of Dr. Max Cutler, who terms it "a simple, safe and valuable aid." Transillumination, seeing through body tissues with the aid of a strong light, is not a new procedure in itself, but this new lamp, powered by a 750-watt bulb, is said to provide much more intense light than other lamps hitherto used. A wall of circulating water cools it so that it can be applied directly to the skin with safety and comfort for the patient.

ELECTROCUTION is the latest method of controlling orchard insect pests at Massachusetts State College. Professor A. I. Bourne, Stewart D. Edmond and Professor C. I. Gunness are studying the effectiveness of five electric insect traps in a local apple orchard to determine the practicability of the method on a wide scale. Each trap consists of a double wire screen enclosing a 75-watt frosted bulb. The light attracts insects at night but as they fly toward it they come in contact with the electrified screen wire. Current at 110 volts cremates them. Some are only killed, however, and fall to a tray beneath the trap. The present installation of five traps is already known to have killed 1,300 insects in a single night, not counting those so completely destroyed that identification is impossible.

GLIDING swiftly down the canyons of New York and Brooklyn, new articulated streamlined trains of light weight will replace on the elevated track the rickety wooden "El" cars which for many years have crashed noisily up and down town, making the light trestles waver every time they come to a halt or started again. Two articulated units designed to fit the needs of the "El" by B. M. T. engineers have been built by the Pullman Company in Chicago, according to *The Engineering News Record*. It is expected that they will make possible a modernization of elevated lines to the point where service and safety standards will equal those of the subways. Built in the days before present engineering standards, most of New York's elevated tracks were not designed to support the heavy coaches and cars which now are the accepted rule for safety and comfort. Consequently "El" coaches have been flimsy; not strong enough to have the good qualities of heavy cars, and not built with the advantages of present-day design in light aluminum-alloy construction.



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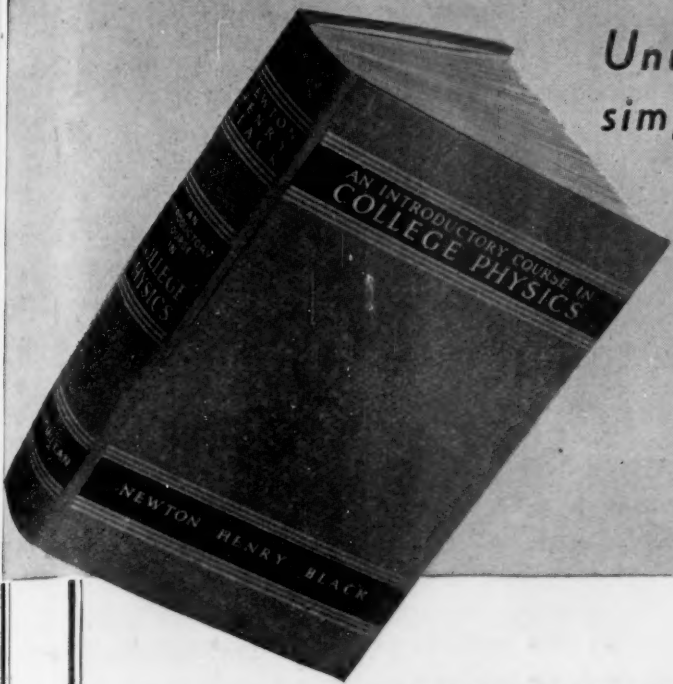
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SCIENCE NEWS

Science Service, Washington, D. C.

THE DISCOVERY OF X-RAYS FROM THE SUN

X-RAYS generated in the sun bombard the earth incessantly, according to a report made by Dr. Ernst A. W. Müller, of the Siemens and Halske Company of Berlin, as the result of a study of the electrified radio "roofs" of the earth's atmosphere. Unlike the sun's light and heat, the solar x-rays of Röntgen radiations do not reach the solid crust of the earth. They are absorbed by the upper atmosphere down to a height of about sixty-five miles, where they electrify the air and create what is known as the Kennelly-Heaviside layer. This E layer, as it is also called, is the lowest of a number of the earth's electrified roofs which keep radio waves from being lost in interplanetary space. It reflects the longer radio waves.

The solar x-rays are thought by Dr. Müller to be more penetrating or softer than the ultra-violet radiations known also to come from the sun. They are "soft" x-rays, having a wave-length around one hundred millionth or one billionth of an inch. His report is based on deductions from many experimental results from England, America and elsewhere. Radio observations during the 1932 solar eclipse and at other times indicated that the agent causing the electrification of radio roof E comes from the sun. At first it was thought that the radiation responsible might be great streams of sun-born neutrons or electrically neutral particles, and later ultra-violet sunlight was blamed. Calculations show that ultra-violet radiation is easily absorbed by the air and that an amount sufficient to create the radio layer would not plumb the depths of the earth's enveloping ocean of air. Following the suggestion of Dr. W. F. G. Swann, of the Franklin Institute, Philadelphia—that fast electrons are produced in sun-spots—most of them, it is explained by Dr. Müller, must lose their energy in the outer layers of the sun and in so doing generate x-rays. This generation also takes place in the unspotted part of the sun.

THE PREVENTION OF SILICOSIS

METHODS by which a combination of engineering and medical sciences are winning their fight against silicosis, once widely prevalent in dust-laden coal mines, was described at a symposium on the health of miners at the recent meeting in New York City of the American Institute of Mining and Metallurgical Engineers. Silicosis is the disease of the respiratory organs caused by breathing rock dust.

Dr. Donald E. Cummings, of the Saranac Laboratory for the Study of Tuberculosis, said that better mine ventilation, spraying with water of air passages and exposed surfaces, delaying of dust-producing blasts until the end of the working shift, all have combined to lower the incidence of silicosis in coal-mine workers. Water curtains, wall-like sprays which keep back dust, have made it possible to reduce dust concentration by 65 per cent.

A new way of preventing dust with a hollow rock drill was described by Theodore Hatch, instructor in industrial sanitation at the Harvard Engineering School. Down the hollow drills flows swift-moving air, which blows the dust out through the bore hole into a dust hood connected with the mine exhaust system. Seldom appreciated, Mr. Hatch indicated, is the fact that in drilling one hundred feet of two-inch bore some 237 pounds of dust will be liberated. In volume it totals three cubic feet.

Dr. R. R. Sayers, of the U. S. Public Health Service, authority on industrial dust, reported studies of what constitutes dangerous dust concentrations in mines. The human system, he said, can tolerate 50,000,000 dust particles for each cubic foot of air if the quartz dust in it is not more than five per cent. If there is 35 per cent. quartz present, however, a concentration of only 10,000,000 dust particles per cubic foot must be avoided.

RESEARCH GAINS IN AVIATION

PEERING into aviation's future, the National Advisory Committee for Aeronautics in its annual report issued recently foresees the following developments:

Large aircraft of greater range and weight-carrying power, because aerodynamic efficiency increases with the size of airplane; engines of larger horsepower, made possible by the committee's research on the fuel injection principle; greater speed, through refinements in design, reduction in drag and increased engine power, and greater use of wing devices that give high lift in order to allow modern high-speed airplanes to land at safe and slow speeds.

Some researches at Langley Field on ways for converting a high-speed airplane wing into one with adequate lifting ability at low speeds are already being incorporated into new designs of American airplanes. The increased speed of modern aircraft, resulting from increased propulsive and aerodynamic efficiency, has been attended by undesirable and in some cases dangerous increase in speed.

Experiments upon the location of engines in multi-engine planes and upon cowling for engines to reduce their wind resistance have greatly increased speed and engine power output without increasing fuel consumed. This research is largely responsible for the sensational increase in air transport speeds in the last two and three years. Engine research results justify the early development of the compression-ignition type of aircraft engine, using Diesel-type fuel, which is heavier, cheaper and less dangerous than gasoline. The building of an engine using spark ignition and hydrogenated gasoline is also foreseen.

With the development of large airplanes and large liquid-cooled engines, there will come a need to house the engines inside the wings. This will call for different types and shapes of engines. Air-cooled engines are expected, however, to be built in sizes up to 1,000 and 1,200 horsepower.

In response to an inquiry by the Federal Aviation Commission, the building of two rigid airships for intercontinental service and the encouragement by the government of the private development and operation of large seaplanes across oceans were urged by the committee. Airships and large seaplanes will compete economically with Europe's new high-speed superships. The problem of promoting private flying on a large scale calls for a combination of improved economics and greater safety.

STONE AGE OCCUPANCY IN GERMANY

THE Ilse Cave in Thuringia, a deep cleft in a massive mineral-bearing rock formation, has recently been investigated from top to bottom by Dr. Werner Hülle, of the Institute for Prehistory in Halle, Saxony. His excavations have disclosed evidences of not less than five different extended periods of Stone Age occupancy. From century to century litter appears to have accumulated on the floor, so that studious dustmen can now burrow downward through the mess and read history from the present time back to the remotest yesterday in mislaid stone tools and lost bone needles.

It was possible to differentiate five distinct layers of debris, each from six to ten feet thick. The top layer was "modern"; it bore evidence of the work of miners during the Middle Ages and broken pottery recognizable as belonging to the Iron and Bronze ages. Then came a layer correlated with the Late Magdalenian culture period in France. This was the latest of the several Old Stone Age civilizations. In the Ilse cave were found flint implements and the teeth of wild boar, fox and other animals, the latter pierced as though for ornament.

The lower part of the same layer showed a long gap in human occupancy, which probably coincided with a temporary return by the retreating glaciers of the Ice Age, for this part of the stratum is thick with the bones of rodents and small birds such as are now found along the northern coast of Siberia. Below this was another layer containing human culture remains. These again could be correlated with a French Stone Age type, this time the Aurignacian. There were relatively few flints, and the bones of game animals included those of the musk-ox, horse and wild cattle. A single human bone, the lower jaw of a small child, was also found.

The lowermost tool-containing layer was also the richest in culture evidences. It was a multiple layer, showing occupancy by three different kinds of people. Uppermost were many patches of powdery charcoal, with flints and bone needles belonging to the Ehringsdorf culture type. Preceding the Ehringsdorf "family" the cave was occupied by people as yet not identified. But litter they left when they moved out showed that they hunted animals now extinct, including the cave bear, cave hyena and a species of rhinoceros. Below this great wealth of tell-tale rubbish was a lesser deposit, left by the first "family" that occupied the cave. They must have been Stone Age "poor folks," because their flint tools were but few, and of quartz and quartzite more than of flint, and their bone tools were small and not particularly good.

There is still a tremendous mass of these ancient family heirlooms left in the unexcavated parts of the cave,

which Dr. Hülle plans to investigate in the near future. Dr. Hülle has reported the results of his investigations to date to the German science publication, *Forschungen und Fortschritte*.

ELASTIC AND MAGNETIC PROPERTIES OF METALS

EXTENSIVE developments on the theoretical explanation of the relationship between the elastic and magnetic properties of metals, involving the orientation of egg-shaped atoms and changes in the atomic lattice work of metals under strain and magnetization, have been made by Professor Francis Bitter, of the Massachusetts Institute of Technology. The use of oriented strains to assist in magnetization and in the creation of permanent magnets is expected to be an important commercial development of this research.

Assuming the tiny atoms of a metal to be egg-shaped and free to turn, the first result of tension applied to the metal, according to Professor Bitter, is that all these atoms line up with their long axes pointing in the same direction as the applied force. After a certain point, when the atoms are all aligned in this manner, the force is used to widen the atomic spacing, which can proceed until the breaking point of the metal is reached.

By magnetizing the metal before applying the force, it has been found that a change in length of the metal is more easily obtained, since the magnetization has already done the preparatory work of lining up the atoms along their long axes. There is an energy loss in hysteresis which is expended turning the atoms into position. Also if a metal is stretched first, it will be much easier to magnetize, since stretching prepares the metal for further alterations, again by lining up the atoms.

The results of the leading experiment on this problem, first performed in Berlin by Dr. R. Becker, correlate closely with Professor Bitter's explanations. In that experiment, a wire with a weight attached to its end was twisted, after which it oscillated for ten seconds before the vibrations ceased. A magnetic field, placed around the wire and parallel to it, so successfully lined up the atoms and overcame the internal friction that the oscillations did not damp out for more than one hundred seconds.

GENIUSES FROM MIDDLE CLASSES

GENIUSES in largest numbers spring from the middle classes of our population, not just from the professional classes, studies of 3,000 school children by the Harvard Psycho-Educational Clinic indicate. In the opinion of Professor Edward A. Lincoln, of the clinic, "We need not expect complete social disaster as a result of the declining birth rate in the professional classes."

Nothing about the physical or mental status of the individual child can be predicted from the occupation of the parent. Professor Lincoln also states that the bulk of our superior children do not come from parents who are in the highest occupational classification, although this group contributes more superior children in proportion to its numbers.

Individual children differ more frequently and in more

important ways than has been supposed. The child not only differs from other children, but he grows different from himself as time passes.

No one trait from the measurement of another can be estimated, nor can a series of measurements be taken early in a child's career, to be used unmodified as a basis for prediction of his status at a remote date. The study of each individual child must be genetic. Measurements must begin early, and must be continued from time to time, keeping full and complete records of everything that can be found out about him.

Beginning in 1921, those at the Harvard Clinic have examined 3,000 children and re-examined them each year to make note of their individual development. The study was conducted under the direction of Professor Walter F. Dearborn.

LYSATES AND INCREASED PRODUCTIVITY

INCREASE in weight and productivity of farm animals may be accomplished by injecting lysates into the muscles of the animals, experiments of Soviet scientists have shown. Lysates are, they explain, medicinal preparations obtained from various organs of animals by means of artificial digestive processes.

Young pigs, after receiving injections of a special lysate, have shown a weight increase of 20 per cent. or more as compared to control animals. Three injections of the same material have increased the weight of adult pigs 24 per cent. The same preparation when introduced into the muscles of horses strengthens these and increases the endurance of the horses themselves.

Lysates have also been used to increase the milk production of goats and cows. The treatment has resulted not only in increase in actual quantity of milk, but also in an increase of the period of lactation itself. Special ovarian lysates have increased significantly the number of eggs laid by hens, and the fat deposits in the hens themselves have also been increased by suitable materials. Of twenty-four cows which had been sterile for from one to three years, nineteen produced offspring after treatment of this sort in another experiment.

At the present time, attempts are being made, by certain Soviet investigators, to apply lysate preparations in combatting epizootic diseases in stock-breeding. The fundamentals have been laid in experiments carried out in Leningrad, at the All-Union Institute of Experimental Medicine, where a lysate-vaccine against typhoid fever was obtained, in combination with a splenic lysate. One injection of this preparation alone was sufficient to render immune all the mice receiving a double mortal dose of typhus-culture.

ITEMS

ULTRA-VIOLET rays, at appropriate wave-lengths and strength of dose, are fatal to the eggs of certain parasitic worms, experiments at the Smithsonian Institution have demonstrated. The total energy of the light applied was equivalent to that of twelve days of average July sunlight, though the actual raying usually occupied only

a few hours. Previous observers of the killing effects of sunlight on these eggs had ascribed them simply to heating and drying out. But the present experimenters, W. H. Wright, of the U. S. Department of Agriculture, and Dr. E. D. McAlister, of the Smithsonian Institution, feel that they have demonstrated a direct lethal effect due to the ultra-violet radiation itself.

A SIMPLIFIED and speedy method of studying atom layers in metal crystals has been developed by Alden B. Greninger, of the graduate school of engineering, Harvard University. This is a variation of the scheme of the German, Max Laue, for "fingerprinting" atoms in a crystal by making the atoms diffract x-rays and having them fall on photographic plates in characteristic spotty patterns. From these x-ray patterns science has been able to tell what type of crystal structure produced them. Such knowledge is vital for studies of metal weaknesses. Instead of making x-rays pass through the crystal, which had to be cut in fairly thin sections in the former Laue method, Mr. Greninger cuts a hole in the photographic plate, passes x-rays through it, lets them fall on the surface of the crystal being studied and finally catches them on the plate as they are diffracted backward. From the characteristic pattern thus obtained the arrangement of atom layers in the crystal can be calculated with relative simplicity.

GIRL college students make less noise but complain more about it than men students. A survey of campus and dormitory noises made by Dr. Donald A. Laird, director of the Colgate University psychological laboratory, announced at Vassar College, one of the colleges studied, attributes the noise irritation of the woman student to "the better discrimination and use women make of their senses." While the volume of noise in the women's colleges records fewer decibels on the measuring audiometers, higher-pitched voices of the girls make the noise problem more acute even though they are softer in volume than the bass and baritone voices of the men.

THUNDERSTORMS and asthma have baffled a group of scientific men at the University of Illinois Medical College. These investigators, Dr. Tell Nelson, Dr. B. Z. Rappaport, Dr. William H. Welker and Dr. A. G. Canar, know they can relieve asthma sufferers by putting them in an air-conditioned ward or room, but they are up against a blank wall as to why the thunderstorm sets the patients back. They believe some factor other than pollen, temperature, humidity and ozone must play a part in bringing on asthma attacks. Filtering out the offending pollens helps the asthma sufferers materially. Keeping the humidity low and the temperature relatively constant helps even more, they now report to the American Gas Association. But even patients who were free of symptoms developed attacks of asthma while in the air-conditioned ward shortly after a severe thunderstorm. Patients in the air-conditioned ward, however, suffered less severe attacks after the thunderstorm and recovered more quickly than patients who had been in a room with filtered but not conditioned air.

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SCIENCE NEWS

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SHORT RADIO WAVES

VERY short radio waves, only a few feet in length, have traveled record distances in Harvard experiments and warm air currents riding above colder air masses are believed to be responsible.

Using a $1\frac{1}{4}$ meter wave-length, signals have been exchanged between a Cambridge experimental station and one at Mount Wachusett, Mass., a distance of 68 miles and probably a record for $1\frac{1}{4}$ meter transmission.

Another record, for $2\frac{1}{2}$ meter transmission, is believed to have been established in the exchange of signals by the Blue Hill Observatory and a station on Mount Washington, N. H., a distance of one hundred and forty-two miles.

These unusually successful results are probably due to temperature inversions, according to Professor Charles F. Brooks, director of Blue Hill Meteorological Observatory at Harvard University, who has had a leading part in the ultra-high frequency radio research at the university.

Ordinarily, air temperature drops with increase in altitude, temperature inversion occurring when the regularity of this fall in temperature is interrupted. Inversions are common at night, when the lower air is chilled. They are also caused by a warm current of air flowing above cold air near the earth, or by an unusually cold current flowing close to the ground under warmer air at a moderate height.

There is a possibility of temperature inversion at four levels in the Kennelly-Heaviside region; at the base of the stratosphere; in the middle of the troposphere, and near the ground. Only the last two, however, seem to be of consequence in ultra-high-frequency radio transmission.

When a temperature inversion occurs, the radio waves which spread horizontally through the atmosphere are refracted in passing from cold or relatively dense air into a layer of warm or light air. This refraction is similar to, but very much less than, the refraction of a beam of light which passes from water into air.

Additional observations by G. W. Piccard, research associate at the Blue Hill Meteorological Observatory, on transmission and reception of five-meter wave signals, showed that there is a well-defined daily change in signal strength, with good reception during the night, best reception during morning and evening, and poorest reception near noon. His automatic records also indicate that there is probably a seasonal fluctuation, with best transmission during the summer.

The usual summertime inversion of temperature over the cold waters off the coast of Maine is believed to have been responsible for two exceptionally long distance transmissions of 5-meter signals last summer.

One was a signal sent from Blue Hill and picked up in a boat off Mount Desert Island, Me., more than 200 miles away. Later in the summer, five-meter signals from

West Hartford, Conn., were received on Mount Cadillac, Mount Desert Island, Me., a distance of almost 300 miles.

CHEMICAL ELEMENTS

DISCOVERY of some twenty new varieties of the chemical elements, called isotopes, was announced to the Royal Society by Professor F. W. Aston, of the University of Cambridge and former Nobel Prize winner, as the result of several years of exacting spectrographic work on a dozen elemental substances.

The census of isotopes kept by Professor Aston shows that two hundred and forty-seven stable element varieties are now known from seventy-nine of the ninety-two elements.

Isotopes in chemistry correspond roughly to non-identical twins in animals, since they are the same stuff, but the atom of one isotope has a different mass or weight than another isotope of the same element.

The new isotopes are of the elements hafnium, thorium, rhodium, titanium, zirconium, calcium, gallium, silver, carbon, nickel, cadmium, iron and indium. They were discovered by mass spectrograph analyses made either by the anode ray or more usual discharge method. The mass spectrograph is an instrument that serves as an extremely sensitive balance for weighing the elements.

Important also was Professor Aston's announcement that he had discovered rays from hafnium, thorium and rhodium for the first time.

Because an average of three and a tenth isotopes for every chemical element has been discovered, this is taken to mean that there is a stable elementary atom for every whole number weight from one to two hundred and ten.

Professor Aston believes that not many more such isotopes are unlikely to be discovered, at least for many years, unless by quite new methods.

Professor Aston cited with approval the theory of Professor George Gamow, Soviet physicist now lecturing at George Washington University, Washington, D. C., that if more isotopes are discovered they will probably be radioactive, breaking down into other isotopes.

Not content with his pioneering explorations of atom varieties, Professor Aston said that he would modify his apparatus in the hope of obtaining still finer and more accurate measurements of atomic masses.

GLAND SURGERY AND HEART DISEASE

REMARKABLE success in the treatment of heart disease by removal of the normal thyroid gland was described at the University of Minnesota by Dr. Elliott Carr Cutler, surgeon-in-chief of Peter Bent Brigham Hospital, Boston, and professor of surgery at the Harvard Medical School.

Dr. Cutler discussed this radical and sensational form of surgery wherein a part of the body distant to the diseased part but having an effect upon it is attacked by the surgeon, as an example of the surgery of the future. He spoke of this change in the treatment of the body as

a unit as "A progression from anatomical to physiological surgery."

It is a step representing the greatly increased knowledge of the function of the body and offering the hope that surgery will become less and less a method by which parts of the body have to be removed in order to effect relief.

Reporting observations made on sixty-four cases in which the thyroid was removed, Dr. Cutler reports that in spite of the almost hopeless condition of many of the cases either because of decompensation or angina pectoris, results were far more favorable than those following any other methods of therapy.

Total thyroidectomy for heart disease was proposed in 1932 and the first operation of this type was reported in 1933.

Both experimental studies and bedside clinical observations had shown a close relationship between the thyroid gland and the heart, and it is known that patients who suffer repeated attacks of over-secretion of this gland eventually show signs of heart failure.

Further observations showed that the speed of the blood flow roughly paralleled the basal metabolism in the body, rising when the basal metabolic rate was elevated and *vice versa*. Influence over the basal metabolic rate is only one function of the thyroid gland, but since it can be measured by a simple test, is commonly used as an indication of thyroid gland function.

Dr. Cutler reports that in patients with decompensated hearts the speed of blood flow is slow. This interrelationship suggested that when the circulatory rate in such patients could not be raised by rest, drugs or other means of medical therapy, the basal metabolic rate should be slowed by removing the thyroid gland.

In the sixty-four cases recounted, the only ones reported thus far, he found that thyroidectomy did drop the basal metabolic rate, which in turn demanded a slow rate of circulation. When this demand dropped to the point where it could be supplied by the crippled heart, equilibrium was established and compensation resulted.

ABSOLUTE ZERO

FROM the low temperature laboratory of Leyden University in The Netherlands a new low in cold temperature is reported. Professor W. J. De Haas and his colleagues have reached one five-thousandth of a degree above absolute zero in their experiments.

Absolute zero is 273.15 degrees below zero on the Centigrade scale, and 459.6 degrees below zero on the Fahrenheit classification.

A mercury thermometer would freeze fast in its glass stem and even the hydrogen in a gas thermometer would change to a mere drop of fluid. No thermometer in an ordinary sense can be used for so low a temperature.

Professor De Haas measures his temperatures with a magnetic thermometer. How it works is bound up with his method of attaining the low temperatures. The Leyden experiments are based on the fact that in chemical salts having random orientation of all their little internal unit magnets, there will be less energy in the sample if

it is strongly magnetized in the field of a giant electromagnet.

Using special salts cooled first to the temperature of liquid helium at only 1.6 degrees above absolute zero, Professor De Haas lowered the energy of his samples by putting them in the field of 30,000 gauss. (Gauss is the unit of magnetism, just as volt is the unit of electrical potential.) The component of the earth's magnetic field which moves compasses, by comparison, is only three tenths of one gauss.

Then quickly the applied magnetic field on the sample was lowered from 30,000 gauss to but 25 gauss. The theoretical unit magnets of the sample, called magnetons, then went back to their normal random positions. They needed energy to swing themselves back. The sole place for obtaining this necessary energy was from the heat of the sample. Thus as the heat energy was used up, the sample became colder and colder.

Shortly, however, the sample began to warm up again to the temperature of the helium bath. Professor De Haas measured the rate of this warming up process by detecting the magnetization of the sample. He obtained a curve showing how magnetization varied with temperature.

The final step was to prolong the curve backward and in so doing he was able to deduct that the temperature of the lowest point was but one five-thousandth of a degree above the real "bottom" of all temperatures.

NUMBER OF PEOPLE OVER SIXTY-FIVE YEARS OF AGE

THE number of persons over sixty-five years of age that will be affected by the legislation for old-age pensions now before Congress is expected to increase greatly in the next few years, doubling in number in thirty-five years.

America is rapidly growing older. Thirty-five years ago, at the beginning of the century, about 4,000,000 people in the United States were sixty-five or older. Today 7,500,000 persons are in that age group. By 1970, the aged will be increased to more than 15,000,000. This outlook for a rapidly aging population is revealed in figures presented to President Roosevelt by the Committee on Economic Security.

Thus, the report indicates, the problem of old-age security is one not of immediate relief alone, but of provision for a growing need in the future.

Not only are the numbers of old people increasing, as one might expect in a growing population, but the proportion of old people is also becoming magnified. In 1900, America had just a fraction over four per cent. in the age group over sixty-five. By 1930, this proportion had increased to 5.4. But by 1970 the committee expects the percentage to have reached 10 per cent. Of every hundred men, women and children in the United States thirty-five years from now, ten will be sixty-five years old or older.

If you are now a young man of thirty, what are your prospects for the future? If you live for the next thirty-five years, you will then be one of the 15,000,000 people in the United States in the "old age" group. The

chances at present are about even that you will be dependent, either on relatives, friends or public charity.

Not so many people over sixty-five are finding employment as they did in the past. If you have been a long time with one firm, a survey has revealed, you are less likely to be dismissed than a younger worker. If you have drifted about a good bit from job to job, you will not have that advantage. In case you do lose your job, you are far less apt to secure new employment than younger workers are.

The committee estimates that although 31.6 per cent. of the men over sixty-five were unemployed in 1900, that high figure has increased to 41.7 per cent. in 1930. And the tendency is still upward.

Will you have saved enough to take care of yourself during your old age? That depends upon your present income. Five and three quarter million families in the United States had in 1929 an income of \$1,000 or less. They were not able to put aside anything for approaching rainy days. Ten and a half million families, the most representative American group, made between \$1,000 and \$2,000. These families saved a total of \$750,000,000. A calculation will show that this seemingly large sum, when divided by ten and a half million, gives a sum for each family of but \$71.

The man who lives to be sixty-five years old may reasonably expect to live 11 or 12 years longer. Women, at the same age, may expect to live 15 years. If you should be among the 15,000,000 who are sixty-five in 1970, and you wish to have an income of \$25 a month for the rest of your life, you should have saved, the committee estimates, about \$3,300 or \$3,600, not \$71.

Only families having incomes larger than \$10,000 a year save as much as this amount on the average.

If only this amount of income is allowed to all the people of sixty-five years and over, the cost of support of the aged would represent a claim upon current national production of \$2,000,000,000 per year, the committee reports. Regardless of what may be done to improve their condition this cost of supporting the aged will continue to increase. In another generation it will be at least double the present total.

DISEASE AND THE INTESTINAL TRACT

THE upper intestinal tract has a natural disinfecting power that, when we are in normal health, kills off most of the germs that come into the stomach by way of the mouth, Dr. Lloyd Arnold, of the University of Illinois, reported to a recent meeting of the Chicago Medical Society. This is the reason why we do not have more diseases of the intestinal tract.

He and his associates have been working for twelve years on determining the bacterial flora of the digestive tract. The lower intestine is very densely populated with bacteria, while the upper intestine and the stomach have normally very little bacterial life. The secretions of the stomach and upper intestine are acid in their reaction, while in the lower intestine the reaction is alkaline. There is, however, no division between the upper and lower intestines; it is the line of acidity that determines the height that the bacterial flora will ascend. Conse-

quently, if, for any reason, the acidity of the upper digestive tract is lessened, the bacterial flora of the lower intestine may ascend even as far as the stomach, and the disinfecting power of the mucous lining of the intestine is not able to function properly.

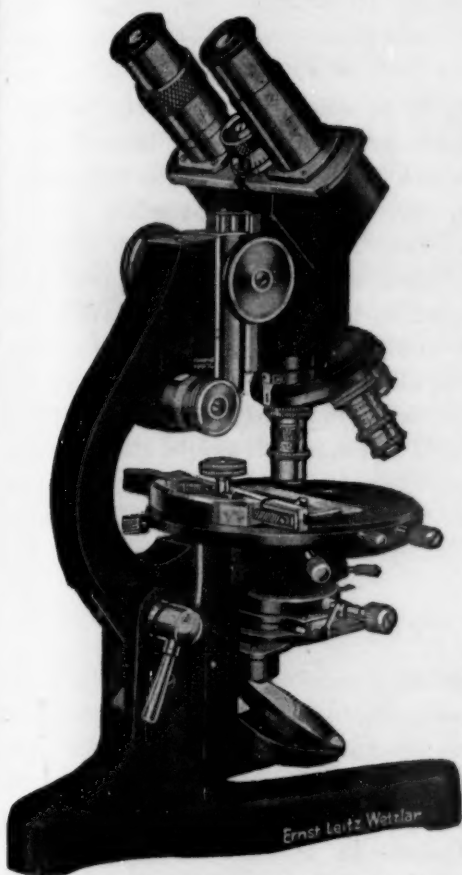
Killing doses of cholera germs were fed to rabbits whose stomach contents were known to be acid. None of these rabbits showed any effect of the germs. The disinfecting power of the upper intestine was able to do its work. The same dose of cholera germs was given to two groups of rabbits whose stomach and upper intestinal contents had been made artificially alkaline. All the rabbits in these two groups contracted cholera and the majority died of the disease. Then a less-than-lethal dose of cholera bacilli was injected intravenously in two sets of rabbits, one with normal intestinal reaction, the other artificially alkalized. The second series became very sick, and most of them died. The other set remained healthy.

Dr. Arnold states that studies they had made showed that in very hot weather the contents of the human stomach were always less acid than in cooler weather. The prevalence of dysentery and typhoid during the hot months is attributed to this cause, and if the diet is such that the acidity of the stomach and upper intestine is maintained at all times, few intestinal diseases can develop. The natural disinfecting power of the upper intestine will be able to prevent them.

ITEMS

DESPITE cold waves, the United States was 90 per cent. "hot" during January. Weather records covering the whole country for the month have been studied by statisticians of the U. S. Weather Bureau, and the results of their figure-digestion have been announced. Nine tenths of the total area reported average temperatures for the month above normal for January. The Rocky Mountain region was relatively warmest, with temperatures in many places ranging from six to twelve degrees above normal. The South also showed mean temperatures above normal, though the paradox of extensive crop injuries from cold resulted from brief but sharp invasions of cold. During one of these cold waves a tenth of an inch of snow fell in New Orleans.

THE air normally has more than enough oxygen to supply the needs of the human body, even under conditions of strenuous physical exertion. The amount of oxygen a man consumes in a minute is the same, whether he breathes ordinary outdoor air or air containing 40, 60 or 90 per cent. of oxygen. These are among the conclusions of a study conducted by Dr. Francis G. Benedict at the Nutrition Laboratory of the Carnegie Institution of Washington. In the experiments which Dr. Benedict reported the amount of oxygen consumed was measured first while the subjects were at rest, then while they expended measured amounts of energy on a bicycle, and finally while they were recovering following the strenuous exertion. A helmet placed over the subject's head enabled the investigators to measure the amount of oxygen consumed, whether the subject was breathing air or air enriched with varying amounts of oxygen.



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SCIENCE NEWS

Science Service, Washington, D. C.

ORCHIDS FROM TOPS OF PANAMA TREES

ORCHID collecting among the tree tops of a Panama tropical jungle, by botanists standing in the bow of a native dugout canoe, was the experience of a scientific expedition from Washington University and the Missouri Botanical Garden, under the leadership of Dr. Carroll W. Dodge. Not only did the botanists paddle their craft up among the tree tops, but the road they followed was the ancient Spanish camino real, or King's highway, over which once trotted caravans of horses and donkeys bearing the treasures of Peru.

The apparently upside-down adventure was made possible by the flooding of a large area of primal jungle with water backed up by the new 170-foot dam at Alahuela, forming Madden Lake, to control floods and supply power and lockage water to the canal. Areas formerly reached only by arduous trips on paths cut through the dense jungle were easily explored in canoes. Since the expedition reached the lake before it was filled to its final level, regions now completely under water were studied as well as lower levels in the forests whose tree tops are still exposed. The party had the opportunity, also, to study the plants of the upper portion of the forest before the trees died. So far as Dr. Dodge knows, this is the first time that such a chance has ever before been offered to botanists.

More than 5,000 plants, representing about 1,800 species, besides a large number of living lichens, orchids and tree-dwelling relatives of the pineapple, were added to the herbarium of the Missouri Botanical Garden in St. Louis and the collections of the garden's tropical station at Balboa.

Of the two other members of the expedition from St. Louis, Dr. Julian A. Steyermark, a graduate student in the Henry Shaw School of Botany, of Washington University, returned with Dr. Dodge, while Paul Allen remained in Panama to make another trip with A. A. Hunter, manager of the tropical station. The expeditions are being financed partly by the Washington University Science Research Fund, established by the Rockefeller Foundation, and partly by the Missouri Botanical Garden.

THE NEGATIVE PROTON

ALTHOUGH perhaps vainly, science is hunting for another fundamental particle—the negative proton—out of which atoms, and hence all matter, may be constructed. To explain and simplify present concepts of how the cores of atoms are composed which need protons, electrons and neutrons to fill the picture, it is hoped that it will be possible to find the negatively charged counterpart of the positively charged protons.

This, in substance, is the conclusion of Professor George Gamow, now visiting professor of theoretical physics at the George Washington University from Russia. Dr. Gamow, who first predicted the layers of energy now found within the atom nucleus, also predicted such

negative protons still to be found. He reports that the search for the negative proton is difficult because man and the planet on which he lives may be in the wrong part of the universe. We live in a world where protons and electrons exist. Yet if the universe as a whole is electrically neutral there must be other regions and worlds where the opposite is true; regions where negative protons and the newly discovered positrons make up atoms. One can think of the splitting of some giant star into two parts. One component might be like the sun and its planet earth. The other half might have charges of the opposite sign. The first part would be a region like that found on earth where protons and electrons predominate. The latter might be the negative proton world.

TREE RINGS

USING a calendar of tree rings, complete from the seventh century A.D. down to the present, archeologists here hope to date diseases that plagued prehistoric Americans of the Southwest. Burial grounds of Southwestern Indians are yielding rich discoveries for an understanding of diseases in America before white men came, says Dr. John H. Provinse, assistant professor of archeology at the University of Arizona, who is studying diseases that marked the bones.

"Reasonably conclusive" diagnosis of seven diseases that troubled American Indians in Arizona has been made. An eighth disease, syphilis, is doubtful, inasmuch as other diseases might have left the perforated palates, thickened long bones and other conditions that suggest this malady.

Dr. Provinse reports that the question of the origin of syphilis in the Old World or the New may be settled by further study of pathological bones in the Southwest and by careful checking with the tree-ring dating charts developed by Dr. A. E. Douglass, astronomer of the University of Arizona. The charts, which set in sequence annual growth rings of trees representing dates for many centuries, have enabled archeologists to discover the ages of over ninety pueblos and cliff dwellings. If fragments of wood, associated with burials of diseased Indians, can be dated by matching growth rings to dated rings of the tree-ring calendar, then dates in America's ancient medical history can be established. Syphilis, in particular, is not yet proved to have existed in America before the coming of Europeans.

Among the ancient American diseases diagnosed by Dr. Provinse in the bones he has studied are Potts disease or tuberculosis of the spine; rickets; osteomalacia, a nutrition disorder of adult women resembling rickets; arthritis, and Paget's disease, which distorted the bones, with such deformities as a bowing of the lower leg.

CHITIN

RAYON, synthetic lacquers and a thousand other things made from wood and cotton cellulose are now chemical

commonplaces. We no longer stop to wonder at them, for they are not miracles any more. Chitin, which is found practically throughout the invertebrate animal world, forms such things as the wings and body-shells of insects and the thick crusty armor of crabs and lobsters. It contains carbon and hydrogen in about the same proportions as they are found in cellulose, but it has less oxygen than cellulose has, and it also contains nitrogen which cellulose lacks, and is to that extent chemically more nearly related to the proteins than to the carbohydrates.

But it is as susceptible as cellulose to chemical manipulation, and if industrial chemists were sufficiently interested could doubtless be converted into many of the same things that now are born from cellulose, such as synthetic fabrics, lacquers, plastics, transparent wrappings. Little has been done with chitin even by laboratory chemists; nothing, apparently, with a view to possible commercial applications.

There is no lack of raw material. The lobster, crabmeat and shrimp packing industries turn out mountains of discarded shells every season, which are now just plain waste. These would have to be treated with acid, to extract the lime they contain, before they could be used. Another possible source of chitin, if it ever becomes a paying proposition, are the insect traps set in orchards, nurseries and other places where the value of trees and shrubs justify the expense of maintaining them.

THE EFFECT OF DROUGHT ON PRAIRIE TREES

DROUGHT, that blasted pasture and crop lands in the West last summer, took toll of the prairie groves of trees also. Careful observations made last summer on the trees that form natural outposts bordering on the great grasslands have been made available by Dr. J. E. Weaver, professor of ecology at the University of Nebraska. Few of these trees and shrubs were killed outright, but the varying degrees of injury suffered by the different species are considered worthy of study in connection with plans for the Great Plains shelterbelt, now under preliminary experiment to the west of Lincoln, Nebraska.

Along the valleys, where the soil moisture is normally most abundant and evaporation rates somewhat lower than those obtaining on the uplands, there was nevertheless a great deal of drought injury. Dr. Weaver and his associates noted willows and wild cherries nearly leafless in the heat. The leaves of box-elder were wilted and dried, and those of the silver maple were discolored as though by frost.

Ash and elm, among the most favored trees for shelterbelt purposes, Dr. Weaver records as having wilted crowns; the ash, especially, was half dried and brown. Of the elms, the scorched leaves did not turn brown or bleach white as did those of other species, but took on a bluish-gray color and soon fell to the ground. On the other hand, black walnut was scarcely affected, perhaps on account of its excellent root system; nor were trees of this species found on even drier sites injured. Hackberry appeared in fair shape.

A contrast between two associated species in the same

environment is recorded by Dr. Weaver. In the bordering belt of linden and red oak on a steep north slope, one third to one half of the leaves of the shallow-rooted linden were brownish-yellow and functionless; many had fallen to the ground. The more deeply rooted red oak had shown as yet no permanent injury, although the portions of the crown most exposed to the sun were wilted in early morning. In the bur oak forest that covered the slopes of the hills, even greater drought prevailed. From a vantage point on a ridge, one could clearly see that many of their tops had been badly scorched and that the leaves were dried. Most convincing to many people, no doubt, will be the notation that the drought was too mean even for poison ivy. Dr. Weaver states that long-established vines, two inches in diameter, bore wilted leaves even in the shade in early morning, from the crown to the base of the supporting tree.

THE DANGER OF MILD CASES OF SCARLET FEVER

SCARLET fever is spread not only by patients seriously sick with the disease but by convalescents and by carriers, who are apparently well yet harbor the virulent germs in their bodies. Some of the worst epidemics have been caused by infected milk, but in every instance the infection has been traced to the presence of persons suffering from scarlet fever, either on the dairy farm or among persons handling the milk.

The scarlet fever germ is present in discharges from the mouth, nose and throat of the sick. If there is a discharge from the ears or from abscesses, this discharge may also be infectious. Because scarlet fever is so highly contagious and because a mild case in one individual may be responsible for serious or even fatal infection in more susceptible persons, the importance of watching for symptoms and isolating suspect cases is emphasized by the U. S. Public Health Service.

Children contracting scarlet fever feel suddenly tired, restless and peevish. High fever and sore throat are characteristic and usually there is a chill, vomiting or convulsions. These early symptoms are usually followed in a few days by a rash, which appears first on the neck and chest and soon covers most of the body. When there is any suspicion of scarlet fever, a doctor should be called and his advice carefully followed. This is important because of the serious effect which the disease often has on the heart, kidneys and ears.

Great care must be taken to prevent discharges from the patient's mouth, nose, throat and ears coming in contact with other persons. Dishes used by the patient must be kept separate from those used by other members of the family and all clothing worn by him should be disinfected. Children exposed to scarlet fever should be kept away from school and from other children, during the period required for the disease to develop. The Dick test may be used to test the susceptibility to scarlet fever. This test makes use of the toxin produced by germs known as scarlet fever streptococci. A minute quantity of this toxin is injected in the skin and if the child is susceptible a red area, about half the size of a dime or larger, will appear at the site of the injection in about

24 hours. If the exposed child is shown by the test to be susceptible but has not yet shown signs of scarlet fever, a larger dose of the toxin may be given at once. Usually five injections are given to immunize susceptibles against scarlet fever, but injections should be discontinued if symptoms of scarlet fever develop.

THE VARIATION OF DISTANCE BETWEEN EUROPE AND AMERICA

TIDES in the solid earth which alter the distance between the North American and European continents by as much as 63 feet have been discovered by Professor Harlan T. Stetson, visiting research associate in astronomy at Harvard University, and Dr. A. L. Loomis, New York broker and scientist, who operates the Loomis Laboratory at Tuxedo Park, New York. These tides in the earth are believed to be caused by the moon through its gravitational pull much in the same manner as it causes ocean tides. They were discovered by the two scientists when discrepancies in astronomically checked clocks in Europe and in North America increased and decreased regularly with changes in the moon's position.

According to Dr. Stetson and Dr. Loomis, discrepancies between European and American clocks, astronomically checked, indicate that the average difference between the two continents may be increased by as much as thirty-two feet when the moon is pulling them apart. When the moon pulls them together they may be closer to each other by the same distance. In conducting their experiments, the two used United States time signals checked at Washington and broadcast from the Naval Station at Annapolis, Md., English time signals checked at Greenwich and broadcast from Rugby, and French time signals checked at Paris and broadcast from Bordeaux. At specified times, each station picks up the signals of the other two.

Discrepancies between time signals from Annapolis and from Rugby were found to rise and fall with the moon's position. A very similar curve designated the differences between Annapolis and Bordeaux signals. Between Rugby and Bordeaux, however, no such relationship was found, indicating that the phenomenon does not take place between England and France. By a stretching of rocks it is well within the realm of possibility for the two continents to move as much as 63 feet apart. Such a movement would be equivalent to stretching a rock a yard long less than .0004 inches, an amount well within the elastic limit even of solid granite.

It was at first thought that changes in the amount of time required for transatlantic radio transmission might be the cause of the discrepancies, or that the moon might lift the Heaviside ionized layer which reflects radio waves and thus gives them a longer distance to travel. Upon checking this, it appeared that no alteration in the Heaviside layer could account for the large size of the time discrepancies. In considering these aspects it was found that the average length of time required for transatlantic transmission is approximately .04 seconds.

ITEMS

A NEW theory of the electron's size, which makes it ten times larger than previously held concepts, was an-

nounced by Dr. Max Born, professor of physics at the University of Cambridge, and Professor Erwin Schroedinger, of the University of Oxford. The electron is one of the fundamental particles out of which all matter is composed. Present estimates of the electron's size suggest that some ten trillion of them side by side would be less than a half inch long.

DR. G. ARTHUR COOPER, paleontologist of the Smithsonian Institution, has made a detailed study of ninety specimens of fossil trilobites, primitive relatives of crabs and crayfish, through all stages of their life development from infants a third of an inch long up to adults nearly four inches in length. In the particular species studied, the body form remained the same throughout life, but head and tail changed as the animal grew. Some of the specimens have been deposited in the U. S. National Museum and some in the Peabody Museum of Yale University, but the bulk of them belong to Colgate University, where they were discovered.

DESPITE dust storms in the West and a severe cold wave over most of the country, recent grain-crop conditions are still favorable, the U. S. Weather Bureau reports. Winter wheat in the Ohio valley is in good condition and moisture is largely ample, relieving a long-continued drought condition. The moisture situation is also good in Iowa and Missouri. In the Plains region, where the dust storms occurred, the drought continues unabated, but in eastern Kansas and South Dakota there is at least enough soil moisture for present needs. Most winter grains are in satisfactory condition in the Pacific states. In the nearer Southwest, southern Kansas, Oklahoma and Texas, spring plowing and disking are already well under way, and some plantings of spring oats have already been made.

MORE people were in mental hospitals in New York State for treatment during the years of the depression than for a corresponding period before that economic catastrophe. During both periods the number was constantly increasing, but in the pre-depression era the increase was at the average rate of 1,600 per year. Since 1929, this increase has jumped to 2,500 per year. That all types of mental disease were affected to some extent by the economic crisis, although it may not have been the dominant fact in the increase in any one disease, is the conclusion of Dr. Horatio M. Pollock, statistician of the New York State Department of Mental Hygiene.

PLENTY of rickets-preventing ultra-violet rays pass through Chinese paper windows and these windows are far superior, in this respect, to ordinary window glass, it appears from measurements of various Chinese window materials made in the physics laboratory of Yenching University. Observers have repeatedly called attention to the fact that rickets is less prevalent among Chinese than among Western children. Paper windows might, therefore, be used to replace the more expensive anti-rickets window-glass now on the market.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE SOURCE OF COSMIC RAYS

JUSTIFICATION for cosmic ray investigations must be found in their value as aids in our better understanding of the universe, rather than sources of industrial power. This was the basic philosophic theme of an address on cosmic rays given by Dr. Thomas H. Johnson, research worker at the Bartol Foundation, Swarthmore, Pa., under the auspices of the Carnegie Institution of Washington, of which he is also an associate.

"The total energy falling upon the earth's surface in the form of cosmic radiation is about one thousandth that of starlight, one billionth that of sunlight," said Dr. Johnson. "If the cosmic ray energy were equal to that of sunlight, the latter would still prove to be the better source of power, for the extreme penetrating ability of the cosmic radiation prevents its concentration for conversion into useful forms of work."

All evidence points to regions beyond the atmosphere as the source of the cosmic radiation. When the detecting instruments used by many investigators in widely separated regions of the earth are pointed horizontally the number of rays detected falls to a very small fraction of the normal vertical-ray count. Furthermore, the higher instruments are carried in balloons, the greater is the cosmic ray registration: on stratosphere flights a 300-fold increase has been recorded.

Intense electrical fields, somewhere in the universe, were suggested as the most likely sources of cosmic rays by Dr. Johnson. He said:

"Accustomed as we are to electrical displays during thunderstorms and volcanic eruptions it is easy to imagine similar processes taking place on stars. Negatively charged clouds of dust or vapor high above the surface of a star could draw from its atmosphere positively charged atomic ions and project them, like the beam of a cathode ray oscillograph, into cosmic space. Nuclei of hydrogen and helium atoms, the principal constituents of stellar atmospheres, would thus become the cosmic rays.

"During their passage through interstellar space small quantities of matter would be encountered in which secondary positive and negative electrons would be generated. The electron component could thus acquire a new significance as an indication of the amount of matter through which the primary protons have traversed before reaching the earth."

THE STUDY OF AIRPLANE PROPELLERS

NEW knowledge of propeller vibration and the possible causes of why propellers break in midair is reported by Dr. Walter Ramberg, Paul S. Ballif and Mack J. West, of the National Bureau of Standards.

Such propeller failures, while rare compared with the number of propellers in service, usually have serious consequences. Often the flying broken parts rip through the wings of a plane, cause a wreck and sometimes loss of life.

Because it was almost hopeless to try and measure the size of propeller vibrations and the forces in blades while they were whirling rapidly, the government scientists produced a comparable effect by working backward.

Instead of the propeller receiving its vibrations during actual flight the experimental test was performed with a fixed propeller made to undergo the vibrations by having its propeller shaft twisted back and forth mechanically. Thus strains and stresses were experienced in the propeller blade similar to those encountered during normal operation. Most important, they could be measured.

It was found the vibrations were those of resonance wherein tiny forces, timed at just the right period, built up and amplified one another until the total effect was enough to snap the blade.

It is such resonance vibrations which are feared when a column of troops is ordered to break step when marching across a bridge. If all the foot beats happened to be timed near the natural vibration period of the bridge, the latter might collapse from the built-up stresses created.

For the experimental propellers two vibration periods were found; one at the frequency of 35 times a second and the other 130 times a second. For the lower frequency of vibration it was found that the greatest stresses occurred at the middle of the propeller blade. Stresses experienced were determined by measurements on a special strain gage invented by Dr. L. B. Tuckerman, also of the Bureau. In the laboratory the scientists made eight propellers break artificially while vibrating with their fundamental frequency. All the blades broke at the mid-point where the stresses were within a few per cent. of the maxima measured.

The results of the research are reported in the forthcoming issue of the *Journal of Research* of the National Bureau of Standards.

THE DETECTION OF ULTRA-VIOLET RAYS

AN old tin can, a bit of old rubber sheeting, a water jet and a spark gap are essential parts of a new ultra-violet detecting apparatus developed by Dr. R. D. Summers, of the department of physics of the University of Pennsylvania.

With the simple and inexpensive equipment it is possible to hear the presence of the soundless and invisible rays which cause sunburn and likewise prove the presence of the still more piercing radiation from radium.

Dr. Summers took an old tin can, cut out the top and bottom and mounted a piece of rubber sheeting across one end. Placing the can on its side he directed a fine stream of water against it. When no vibrations were present the water jet hit the rubber and flowed silently to a collecting trough. Vibrations, however, make the water stream strike with less smoothness and—like the string and can telephone systems of boyhood—the sound comes out as a rattle and chatter. The same sounds issue from the can when a source of ultra-violet light or radium rays is brought into the vicinity of the apparatus. So sensi-

tive is the device that the ultra-violet light from a match held several yards away can be detected.

The frequency of the clicks issuing from the apparatus, Dr. Summers finds, is a measure of the intensity of the ultra-violet light or of the radium rays.

Immediately adjacent to the water jet is a spark gap connected to a 2,000 volt source obtained from a small transformer like those used in lighting neon advertising signs and passed through a rectifying radio tube to convert it into direct current. The spark gap is adjusted to a distance where the spark is just unable to jump the gap. Attached to one spark gap terminal is an electrode set close to the stream of water issuing from the jet. Being charged to 2,000 volts it attracts the water stream slightly.

As ultra-violet light or radium rays fall on the copper terminals of the gap electrons are emitted and the conductivity of the gap cut down. At the same time the electrical voltage on the gap is decreased. Hence the attraction of the terminal for the water jet is varied and the stream falls on a different place on the rubber sheet of the tin can.

It is the minute varied spraying of the water stream on the rubber—like a gardener watering a lawn—which creates the tell-tale sounds and thus detects ultra-violet light.

AN INSTRUMENT TO INDICATE TEMPERATURE AND HUMIDITY

A NEW instrument invented by Athelstan F. Spilhaus, of the Massachusetts Institute of Technology, has been called an "air mass indicator," but for every-day purposes it might well be christened a "comfortometer." It combines a thermometer to measure the temperature with a hygrometer to measure the humidity of the air, in such a way that a single pointer can tell you whether you have a right to be uncomfortable or not.

The new instrument was designed to face the universally known fact that humidity does have a lot to do with how hot or how cold it feels. As everybody has experienced many times, a hot, dry day is more tolerable than a hot, muggy one, because if there is little moisture in the air, perspiration evaporates readily, producing a cooling effect. A straight thermometer reading therefore means little, but combined properly with a humidity reading it has significance.

Mr. Spilhaus has succeeded in doing this by having a pointer, which indicates humidity, move over a dial which itself moves to indicate temperature. The dial is of a rather thick crescent shape, and is pivoted at one end. Attached to it is a strip made of two metals that expand unequally when heated, and must therefore bend, thus causing the dial to move up and down. The humidity-indicating pointer is attached to hairs that lengthen in moist air and shorten in dry, causing it to travel back and forth over the dial.

There are two kinds of dials. One, for scientists, is marked with symbols understood by initiates in the mysteries of meteorology. The other, for everybody's use, bears such every-day terms as raw, keen, damp, dry, muggy, scorching, heat prostration. There is also a

blessed "island of comfort" in the middle—though it looks discouragingly small as compared with the "sea of troubles" with which it is surrounded. However, at least for indoor use in really modern buildings, the air-conditioning engineer can see to it that the pointer does not stray off that "island."

The instrument can also be used as an ice warning indicator for aircraft. Ice formation on the wings and other surfaces of airplanes is a serious problem, but hitherto pilots have had no instrument to check by, other than a thermometer. But subfreezing temperatures are not dangerous unless the accompanying relative humidity is nearly 100 per cent. With an air mass indicator substituted for the thermometer, the pilot can tell at a glance whether it is time to begin worrying about ice on the wings.

Mr. Spilhaus emphasizes the fact that his instrument is not intended for use in forecasting weather. It is designed solely to give a more accurate and significant reading of the weather of right now.

THE ANTIQUITY OF MODERN MAN

THE cradle of modern man is again in doubt, as British scientists renewed their controversy over the age of African skeletons heretofore hailed as the oldest of modern humans and said to be some 60,000 years old.

A Scotch verdict of "not proven" is the set-back given to the antiquity of the African remains famous throughout the scientific world as "Kanjera Man." Professor P. G. H. Boswell, geologist of the Imperial College of Science, announced in a letter to *Nature* that he visited the region in Kenya, East Africa, where the skeletal remains were unearthed, and that he failed to find the site. It had been his intention to establish the geological age of the earth layer where the bones were deposited, geological evidence being one of the most convincing clues to the antiquity of such human remains.

The ancient human type called Kanjera Man, discovered by Dr. J. S. B. Leakey in 1932, consists of three skulls and skeletal fragments. These long-ago Africans walked erect and had other traits of modern human beings. Dr. Leakey has maintained that the site is of the Middle Pleistocene period of geologic history. This would indicate that Africa had humans of modern racial type so early that Europeans were still of the shambling, stooped Neanderthal race, a type which became obsolete and vanished from the earth.

A conference of the Royal Anthropological Institute was called in 1933 to hear Dr. Leakey report on his discoveries, and the conference gave a verdict that he had not exaggerated the age of the African remains. This opinion was based partly on the types of animal bones associated with the bones of man. Meanwhile, American anthropologists have remained cautiously skeptical, awaiting such confirmation as Professor Boswell sought to obtain, and failed to find.

Professor Boswell records that his failure in identifying the site was due partly to errors connected with the exhibited photographs of the earth beds, and to the fact that deposits in the area had frequently been disturbed by slipping.

THE TREATMENT OF MYASTHENIA GRAVIS

CONQUEST of a rare and usually fatal disease of muscle weakness seems a little closer, with the announcement by physicians in London of a new method of treating it. The remedy, a complex chemical having the trade name of Prostigmin, is not a cure and provides only temporary relief. It is important, medical scientists point out, not only because it gives greater relief of symptoms than anything so far tried, but because it attacks the seat of the disorder. Apparently it repairs the mechanism damaged by the disease and consequently should lead to an understanding of its cause and possibly eventually to its cure.

Results of Prostigmin treatment in seven cases of the disease have just been reported by Dr. E. A. Blake Pritchard, of University College Hospital, London, to the *Lancet*. Dr. Pritchard used this treatment following the report by Dr. M. B. Walker, of St. Alfege's Hospital, of unmistakable improvement she observed in three patients treated with Prostigmin.

Myasthenia gravis is characterized by gradual weakness of the muscles, although they do not waste away. The patient first notices that he is getting very tired. He sees double. Then he may have trouble in walking, or in lifting his arms or in grasping things. His jaw muscles become weaker, finally they may be so weak that he can not chew. Various remedies have been tried, none, according to Dr. Pritchard, so successful as Prostigmin.

Dr. Pritchard found that his patients showed some improvement within the first five minutes after injection of Prostigmin and atropine. The latter drug is given to counteract the effects of Prostigmin on the heart. Within thirty minutes the patients improved to a degree far greater than when treated by any other method.

The cause of this strange disease is not known, but it seems to be due to interference or blocking of the messages from nerves to muscles. According to the theory, stimuli to muscles, the orders to go into action, are conveyed by the liberation at the nerve endings of a substance called acetylcholine. In myasthenia gravis the order for action is not delivered to the muscles, either because not enough acetylcholine is formed or else because it is destroyed too rapidly.

The ultimate usefulness of Prostigmin as a remedy for myasthenia gravis is somewhat doubtful, since this same medical authority points out that "it has yet to be learned whether frequent injection of the drug does more good than harm to sufferers from this disorder." But because its effect is more than palliative in that it affects directly the mechanism that is out of order, Prostigmin may prove a most significant clue to final solution of the problem of what causes this disease and how it may be cured.

ITEMS

A NEW high figure for scarlet fever cases has been reached in the present wide-spread outbreak. Almost 8,000 new cases were reported by state health officers to the U. S. Public Health Service during the week of March 2, the latest for which figures are available. More new cases are being reported than at any time in the past seven years. The present increase throughout

the nation coincides with the usual seasonal rise and will therefore probably continue to the end of the month as the peak of the seasonal rise in scarlet fever cases usually is reached by the end of March or the first week in April.

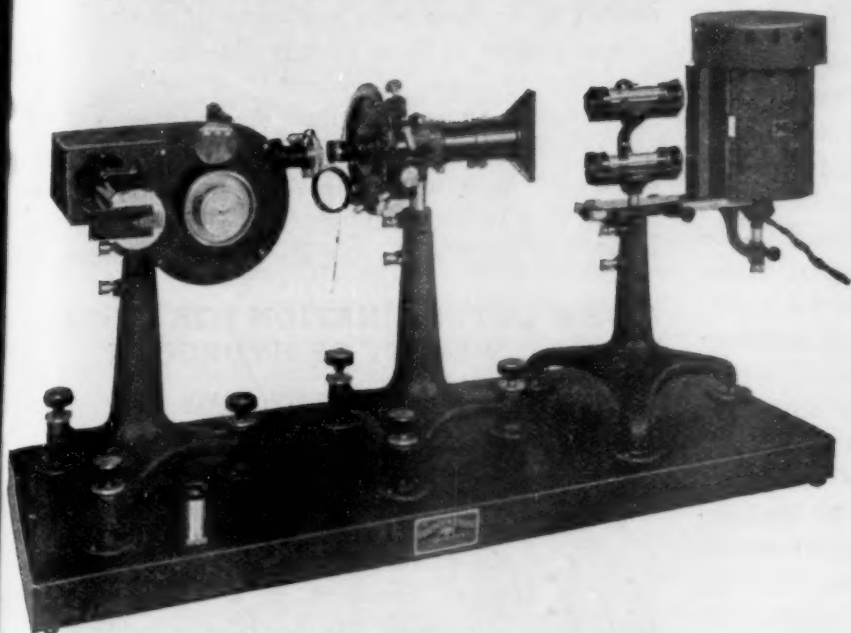
INFRA-RED radiation, the "dark invisible light" that lies just below the lower end of the visible spectrum, has been found useful in the study of fossil leaves found in layers of coal, by Professor John Walton, paleobotanist of Glasgow University. Fern-like leaves in coal are usually studied by lifting them off, carefully spread out on some adhesive substance on a glass slide, which permits them to be handled under the microscope. Frequently they are so dark as to be quite opaque to both eye and camera with ordinary light. But to infra-red radiation many of them are transparent, permitting fine details of structure to be photographed. Professor Walton has reported on his new technique to *Nature*.

WHETHER the brightness of a meteor is due to the speed of the shooting star as it plunges through our atmosphere or to the speed with which it is traveling should be known shortly as a result of investigations now in progress at the Harvard College Astronomical Observatory. Observations are to be made under the direction of Fletcher Watson, assistant in astronomy, of each of the meteor showers that occur at intervals throughout the year. The principal ones occur approximately on April 22, May 25, July 29, August 12, November 17 and December 12.

THOUSANDS of young men at CCC camps who have been completely free of pneumonia this winter are the living proof of the success of a new pneumonia vaccine discussed with physicians of the Johns Hopkins Medical School by Dr. Lloyd D. Felton, of the Harvard Medical School. After proving its safety by trying it on himself nearly two years ago, Dr. Felton has given the vaccine to some three thousand men, none of whom developed pneumonia. In a control group of fourteen thousand who did not receive the vaccine, about forty cases of pneumonia developed. The vaccine is made by chemical treatment of the pneumonia germ, which bears the scientific name *Pneumococcus*. A remarkable feature of the new vaccine is that it protects against any of the four types of pneumonia germs which may cause the disease. The vaccine for preventing the disease will not be ready for public use until many more tests have been made.

THE latest aid to infancy is a tablet called cevitic acid. The name is coined and means an acid containing vitamin C. Its successful use in treating babies with scurvy is reported by Dr. Arthur F. Abt and Dr. I. M. Epstein, of the Northwestern University Medical School. Most babies are given orange juice or tomato juice, both of which contain vitamin C, to protect them from scurvy. For babies who cannot retain either of these juices or who have been deprived of it by circumstances until scurvy has developed, these physicians have successfully used cevitic acid in treating the disease. The acid is commercially prepared from vegetable sources, such as cabbage, paprika, orange or lemon juice, and comes in tablet form.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE PRODUCTION OF TRIPLE WEIGHT HYDROGEN AT PRINCETON

By "boiling down" seventy-five tons of water over a period of a year, ten drops of the precious liquid, richer in rare "hydrogen three" isotope than any ever made before, has been obtained by the chemistry department of Princeton University. According to Professor Hugh S. Taylor, chairman of the department, who described the work before the Electrochemical Society, one part in ten thousand of the half gram is fluid in which the hydrogen is of mass three instead of mass one as in ordinary water.

In the drinking variety of water the rare isotope of hydrogen is present to the extent of only one part in ten thousand million. Such extremely minute concentrations are comparable with those encountered by Madame Marie Curie and her husband in their original experiments on the extraction of the element radium from its ores. Radium ore which will yield one half a gram of radium for five tons of ore is considered remarkably rich. Radium ores producing a half gram of radium for 100 tons of ore are worked commercially.

Explaining the work, Professor Taylor said:

"In addition to the hydrogen isotope deuterium of mass 2 discovered by Professor Harold C. Urey, of Columbia University, for which he received the Nobel Prize in 1934, it is now known that a third hydrogen of mass 3 also exists. This still heavier atom of hydrogen has been produced artificially in Cambridge, England, and in the Palmer Physical Laboratory of Princeton University by nuclear disintegration processes.

"About a year ago by the use of the mass spectrograph designed by Dr. Walker Bleakney, of Princeton, it was shown that the 'heavy water' (deuterium oxide) contained small amounts of the third isotope, tritium, but in a concentration estimated at one part in 200,000 of the 'heavy water' examined.

"During the year the same process of concentration by electrolysis has been continued by Dr. P. W. Selwood, of the Frick Laboratory. There now remains a residual ten drops (one half cubic centimeter) from the electrolysis of 75 tons of ordinary water. The tritium concentration has steadily increased until it is now approximately one part of tritium for every 10,000 parts of deuterium water. The experiments show that in ordinary water this type of hydrogen is present to the extent of only one part in ten thousand million parts of water.

"Similar experiments to ascertain whether the electrolytic process concentrates the heavy oxygen of mass eighteen over that of normal oxygen of mass sixteen have shown that this method is much less efficient. A concentration of water by electrolysis from 120,000 volumes to one volume increased the heavy oxygen concentration merely from one part in 500 to one part in 450.

"While such changes in the ratio of the two species are sufficient for many scientific experiments, it will be

necessary to utilize other methods of separation if it is desired to produce pure specimens of the two forms of oxygen similar to those already obtained with deuterium, the heavy hydrogen of mass 2."

Commenting upon the effect the knowledge that hydrogen of mass 3 could be produced by the electrolytic process would have upon scientists, Professor Taylor predicted that it would intensify the interest in this field which was initiated by the discovery of "heavy water."

A NEW DETERMINATION FOR THE ATOMIC WEIGHT OF HYDROGEN

By WATSON DAVIS

*Director, Science Service**(Copyright, 1935, by Science Service)*

A DRASTIC shake-up in science's conception of the weights of the atoms which make up everything in the universe appears imminent, in a report to the Royal Society by Professor M. L. E. Oliphant and A. E. Kempton, of the Cavendish Laboratories of the University of Cambridge. Lord Rutherford, commenting on the discoveries of his colleagues, said that as a consequence of their new discoveries in transmutation experiments on the relationship between hydrogen and oxygen in ordinary water, science sees a way to get around what has been a serious conflict in reconciling disintegration experiments with the laws of the conservation of energy. The worrisome trouble in the past, Lord Rutherford said, appears to have been that the widely recognized measurements on the ratio of the weights of oxygen and hydrogen in water erred by a factor of one part in four thousand.

Correcting Professor F. W. Aston's measurements made on his original "atom scale," the mass spectrograph, by this factor Professor Oliphant finds a beautiful reconciliation for the energies of particles shot out in atom-smashing experiments with the theoretical loss of mass in the process. The discrepancies in the past have raised the question whether more undiscovered fundamental particles exist. The new Cavendish experiments discount such questions.

The new atomic weight of hydrogen is now 1.0081 instead of 1.0078. If the new finding is substantiated independently, every atomic weight table in the science text-books of the world will be obsolete, for the weights of the various atoms are all based on the weight of hydrogen. Any changes in the weight of the latter involve all the other 92 elements. Determining atomic weights by measuring the distance they fly from smashed atoms is now a method more than ten times as accurate as the mass spectrograph, heretofore considered the most accurate of all atom scales.

THE TRANSMISSION OF ULTRA-SHORT RADIO WAVES

A WORLD'S record for long-distance transmission of ultra-short radio waves was achieved when the Buenos

Buenos Aires, Argentina, radio station LSL was heard in London, 6,000 miles away. The waves that carried the record-breaking signal were the station's "first harmonics," having a wave-length of seven meters. Their fading characteristic was quite different from that of the primary fourteen-meter signal.

Engineers of the British Broadcasting Company are greatly interested, because there is evidence that the seven-meter signal was carried by reflected waves, after the fashion of the longer wave-lengths, and were not refraction waves or waves of optical nature with their straight-line range extended by starting from a great height, as in an airplane. Hitherto all ultra-short wave transmission records have been established by one of these two methods. The new record is far in excess of the old one that stood until recently, which was only from Berlin to London.

The British Broadcasting Company is especially interested in the reported new long-range record for ultra-short waves, because it expects to start television broadcasting on a seven-meter band during the coming fall. Their pictures will scan at a fineness of 240 lines to the inch. The new Buenos Aires-London record holds out the possibility that this television broadcast may reach much farther than expected.

Television broadcasts are to start in Germany within the next few months. They will probably scan at 180 lines to the inch, with 25 frames per second, and have been announced as the world's first high-quality regular television programs. With the new British television broadcasts in prospect, a sort of unofficial race looms between Britain and Germany.

LIGHT REQUIREMENTS FOR NORMAL READING

You need not buy electric light bulbs of extremely high wattage in the fear that use of less powerful lights will ruin the eyesight of members of your household, according to the results of research made by Dr. Miles A. Tinker, of the University of Minnesota.

Reading by lights of lesser intensity does not cause eyestrain unless the eyes are abnormal or the print illegible. In fact, the contrary may be true. Lights of the extremely high intensities often recommended as healthful and necessary may cause discomfort by producing glares.

A minimum of from 25 foot-candles to several hundred has been recommended for reading in the home. The foot-candle is a unit of illumination arrived at by dividing the candle power of the light by the square of its distance from the illuminated surface.

For example, suppose this article is read by the light of a bridge or reading lamp shining directly down on to your paper from a distance of about three feet. The bulb, say, is about 60 candle power (60 watts). Then the illumination on the paper would amount to at least 6.6 foot candles. Experts estimate, however, that the concentration of light caused by the lamp shade might magnify this figure about four times, but this still might leave the illumination below the formerly prescribed minimum of 25-foot candles.

"There is no valid evidence to support the suggestions that the normal eye needs from 25 to several hundred foot-candles of artificial illumination for easy and efficient reading of legible print." For all but abnormal eyes and the reading of illegible print, 10 to 15 foot candles furnish an ample margin of safety in brightness of illumination," Dr. Tinker said. This would mean substituting a 25 candle power bulb for the 60 in your close reading lamp with no harm to the eyes, or the 60 watt lamp could be placed at a much greater distance.

Diffusion of light has a great deal to do with the intensity that should be used. With well-diffused indirect lighting, the intensity may be increased to any desired level without harm to the eyes, but with direct or indirect systems where the light is not well diffused, the higher intensities result in increased glare and should be avoided.

"If the print paper is glazed or shiny, glare becomes more annoying as the intensity of light which is not well diffused is increased. The paper in many magazines and books has varying degrees of gloss, and the light in the majority of living rooms and offices is not well diffused. Consequently, increase of light intensity usually means increased glare. It is highly probable that, with the best diffusion available in the ordinary home and office, the light intensity should not be higher than about 15 foot-candles."

Dr. Tinker's recommendations for reading legible print with the normal eye are as follows: (1) For direct lighting with poor distribution, 3 to 5 foot-candles; (2) for combinations of direct and semi-indirect illumination frequently found in homes, 5 to 10 foot-candles; (3) for the better degrees of light distribution found in some homes and offices, 10 to 15 foot-candles.

For abnormal eyes, or for difficult eye tasks such as the discrimination of fine details, the intensities should be greatly increased. The diffusion should be adequate, however, or eyestrain can not be avoided.

Dr. Tinker's complete report appears in *The American Journal of Optometry*.

VICTIMS OF THE VENUS FLYTRAP

VENUS's flytrap might with equal correctness be called a spider-trap. This famous insect-catching plant, once called by Darwin "the most wonderful plant in the world," has been re-studied recently by Professor Robert F. Griggs, of the George Washington University, who reported his findings before the Royal Canadian Institute. Professor Griggs discovered that the largest single class of animals among its victims consists of spiders. Examination of hundreds of its trap-like hinged leaves showed that spiders formed 28 per cent. of all its catch. Flies came second, with 24 per cent.

Other prey included beetles, ants and roaches. There was one tiny toad, a scorpion, a couple of snails and one daddylonglegs. In general, the plant's victims were mainly insects that fly little or not at all; there were few highly active fliers like bees and wasps.

Professor Griggs made an effort to find an answer to the old question of what use the plant's carnivorous tendencies are to it; for though it secretes a ferment like

the gastric juice, it has never been proved that it uses the captured victims for food. He was not able, however, to arrive at any completely conclusive findings, for specimens grown in various types of soil, some fed and others kept without insects, all thrived about equally.

It is probable that the species once had a far greater range than its present restricted area of about a hundred-mile radius of semi-swampy coastal plain around the city of Wilmington, N. C. Its nearest existing relative is found in Europe. Two colonies of it were experimentally transplanted into bogs far to the north of its present habitat some years ago. One of these is in Maryland just outside the District of Columbia, the other in Virginia. Both colonies survived the severe winter of 1933-34, which was far colder than anything these plants have been called upon to endure for probably thousands of years.

Professor Griggs expressed the wish that people generally might abandon the rather awkward and unbeautiful name, Venus's flytrap, and adopt the more euphonious botanical name, *Dionaea*, for common use, as they have already adopted such strictly scientific names as *chrysanthemum*, *rhododendron* and *gladiolus*.

A CANCER-PRODUCING CHEMICAL FROM BILE ACID

PRODUCTION of synthetic methyleholanthrene, a cancer-producing chemical previously obtained from bile acid, has been announced at Converse Memorial Laboratory at Harvard by Professor Louis F. Fieser. Easy manufacture of this chemical is expected to facilitate greatly experiments with mice, attacking the perplexing question of the mechanism whereby hydrocarbons of a particular molecular pattern are able to start malignant growth or cancer.

Acquisition by the organism of certain hydrocarbons related to anthracene of coal tar has previously been defined as a condition which can lead to cancer. Already the ability of the newly produced chemical and five others to produce cancer in mice is being studied with the aid of the spectroscope.

Another line of attack is the investigation of chemical transformations of bile acids, sterols and sex hormones normally present in the body to determine whether any of these can be converted into cancer-producing substances like methyleholanthrene by processes akin to those metabolic processes that normally go on in the body.

Further attempts are being made to synthesize hydrocarbons likely to possess a still higher degree of cancer-producing activity, for this would still further facilitate animal studies and might reveal the nature of the cancer-producing activity.

ITEMS

CONSTRUCTION of the new Soviet stratosphere balloon "Osoviakhim-2" is progressing rapidly. While its crew of three men are yet unnamed, plans call for a period of parachute jumping for the appointees as training for the flight. The gondola of the balloon is being made

from rustproof steel with welded joints. The gas bag will be fabricated from high grade rubberized material sewn together. The crew of three will consist of a commander, in charge of ground operations and gondola discipline; a pilot for navigating the balloon, and a scientific man for taking observations and operation of scientific instruments.

A SPECIES of the crustaceans at first known only from Honolulu has turned up on the coast of Natal, where it was identified by E. C. Chubb, curator of the Durban Museum. The wandering lobster, which has already half encircled the globe, was reported successively from the East Indies, from Reunion Island in the Indian Ocean, and from Mauritius. Zoologists are waiting now to see whether it will continue its journey around the Cape of Good Hope and into the South Atlantic.

FLORIDA's picturesque Seminoles who hide in the lonely cypress swamps of the Everglades and live on their old-time diets have almost perfect teeth, according to information given to the Office of Indian Affairs. A dental survey of the 600 Seminole Indians in Florida has just been completed by Dr. Weston A. Price, of Cleveland. Those groups of Seminoles who have left the swamp land to live on the fringes of civilization and to enjoy its conveniences present an entirely different dental picture from the "wild" Seminole. Their contact with ways of civilized men have given them "an atrocious amount of dental decay."

WHAT fishes ate in the sea that once flowed where the mountains of West Virginia now stand has been the subject of study by Dr. Paul Holland Price, of the West Virginia Geological Survey. The answer is simple: they ate each other. Dr. Price has made a great collection of the undigested remains of meals eaten by the fishes of something well over a hundred million years ago in the rocks around Morgantown, W. Va. In these fossil lumps, known to geologists as coprolites, he has found evidences of bone and scale material, and not much else. In the same strata he has also found abundant fossilized fish scales.

BIRDS avoid butterflies whose bright coloration advertises their inedibility, according to a report in *Nature* by Professor G. D. Hale Carpenter, of Oxford University. He received the information on which he bases his communication from a naturalist in Africa, T. H. E. Jackson, of Kitale, Kenya Colony. On an expedition into Uganda, Mr. Jackson noticed birds feeding on butterflies that crowded among the flowers of a blossoming tree. Under the tree he found many wings of the insects, broken off by the birds before they swallowed their prey, some of them with the marks of beaks imprinted plainly on them. By comparing the numbers of these witnesses of insect tragedy with the relative abundance of the various species he could see in the tree, Mr. Jackson made an estimate of the feeding preferences of the birds. This estimate, he says, supports the idea that birds avoid colored butterflies.

New publications in the field of science

A TEXTBOOK OF GENERAL BOTANY

By G. M. Smith, *Stanford University*; and J. B. Overton, E. M. Gilbert, R. H. Denniston, G. S. Bryan, and C. E. Allen, *University of Wisconsin*

A new and completely revised edition of the "Wisconsin Botany." In revising this text, suggestions from users all over the country have been considered. A great part of the material has been rewritten and much new material added. While the general plan of the book has been retained, some changes in division and arrangement of material have been made to make the book more readily adaptable to courses of different lengths. Summaries have been added to most of the chapters. Nomenclature has been Latinized throughout to conform to standard usage.

To be published April 2nd

Probable price, \$3.75

LABORATORY MANUAL IN GENERAL BOTANY

By Emma L. Flisk, *University of Wisconsin*, and Ruth M. Addoms, *Duke University*

The revision of this manual follows that of the TEXTBOOK. Every care has been taken to make it usable in various courses. The material is so presented that it may conveniently be used for the full year's course, for the one-semester course, or for two quarters. There is considerable new material—notably on soils, water relations, types of foods, the algae, and on the general survey of the plant kingdom.

To be published in April

Probable price, \$1.00

DIRECTIONS FOR THE DISSECTION OF THE CAT

By Robert Payne Bigelow, *Massachusetts Institute of Technology*

Entirely revised, rewritten, and rearranged for greater convenience and effectiveness. The new arrangement now makes possible a complete dissection on only one specimen. Directions for procedure have been largely rewritten, clarified, and expanded where necessary to make them absolutely clear to the student. New material has been added on muscles. Illustrations have been added to aid in particularly difficult parts of the dissection. An exceptionally complete, up-to-date reference list is given.

Published March 19th

Price, \$0.90

LABORATORY MANUAL FOR GENERAL GEOLOGY

By Mark H. Secrist, *Johns Hopkins University*

This new manual covers both historical and physical geology. Both text and exercise material have been developed to work hand in hand with any standard textbook for the course in general geology. The maps, illustrations, and diagrams are particularly excellent. Topographic and geologic maps of the U.S.G.S. are used. Line drawings and diagrams are closely related to the text and permit easy labelling. Diagrammatic drawings of fossils are exceptionally clear and helpful. Material on block diagrams is included. There is a more detailed and systematic study of fossil plants and animals than is usual. The tables are another special feature of the book. They are unusually simple and accurate. A table giving the divisions of geologic time is included.

To be published March 26th

Probable price, \$1.75

SCIENCE NEWS

Science Service, Washington, D. C.

PERMANENCE AND PERSISTENCE OF GENES IN THE FRUIT-FLY

THREE hundred successive generations of descendants of one individual have been reared during the past fifteen years in the laboratories of the Johns Hopkins University. This constitutes the longest single breeding experiment ever carried out, so far as known, according to Professor Raymond Pearl, the Johns Hopkins biologist, who made a report before a recent meeting of the Washington Academy of Sciences. Translated into terms of human generations, it would carry us back to 7,000 B.C., at the dimmest twilight beginnings of the Bronze Age and before the dawn of history.

Crowding 300 generations of a living organism into half a human generation of time was made possible by the use of the little gnat-sized insect *Drosophila*, known variously as fruit-fly and yeast-fly. Its life-cycle can be completed in three weeks, instead of the human thirty years.

The experiment consisted in starting with a single normal male, mated to a female with vestigial wings. Normal males were selected from each hybrid generation, and always bred back to vestigial-winged mates. In the end, the "genes," or hereditary units determining normalcy in wings, were still there, striking evidence of the permanence and persistency of these factors in the reproductive process.

Professor Pearl then called attention to far longer persistence in hereditary patterns of other organisms in nature. Some of the lower forms of animal life have come down unchanged through geologic periods measured in tens of millions of years.

Yet for all this demonstration of potency on the part of the hereditary units, the speaker cautioned against too easy acceptance of doctrines ascribing all-importance to heredity as against environment in human affairs.

"The full implications of the reciprocally determinative influences of organism and environment seem to me to have been generally somewhat less than adequately valued in the last century's development of biological thought," he said, "and certainly an extremely inadequate amount of first-rate research has been put upon the matter."

Nor was he willing to subscribe to the doctrine that birth control, in limiting the reproduction of the "upper classes" while the poor continue to breed, is "ruining the race." Making it plain that he supports the idea of birth control, and especially that he believes in checking the increase of the hereditarily diseased, Professor Pearl said:

"It is assumed that generally speaking and with negligible exceptions the more fortunate social and economic classes are in that position because they are composed of not only mentally, morally and physically, but also genetically superior people. But it may be alleged with at least equal truth that these very people who are re-

garded as mentally, morally and physically superior are that way in no small part only because they and their forebears have been fortunate socially and economically.

"The analogy often drawn between human breeding and live stock breeding is in part specious and misleading. In animal breeding it has been learned that the only reliable measure of genetic superiority is the progeny test—the test of the quality of the offspring actually produced. Breeding in the light of this test may, and often does, lead to the rapid, sure and permanent improvement of a strain of live stock.

"But when the results of human breeding are interpreted in the light of the clear principles of the progeny test the eugenic case fares badly. The vast majority of the most superior people in the world's history have in fact been produced by mediocre or inferior forebears; and conversely the admittedly most superior folk have in the main been singularly unfortunate in their progeny.

"The arguments adduced by the crusading eugenicists to get around these disconcerting facts, when freed of irrelevant and misleading details, reduce themselves to two categories—indignant denials of the clear and patent facts, and personal abuse of the opposition, in respect of both its intelligence and its integrity. But calling men fools and liars advances neither science nor humanity."

PROTECTION AGAINST MEASLES

WITH measles on the rampage and new cases being reported at the rate of over 30,000 a week, particular interest attaches to the latest reports on how the disease spreads and on results obtained with convalescent serum as a preventive measure.

Preventive serums have captured the popular fancy, perhaps because of their appearance of magic. A prick of a needle, a "shot in the arm," and presto! your body is endowed with a mysterious, invisible power that protects you against diphtheria or typhoid or some other dreaded malady.

In the case of measles, convalescent serum from the blood of recently recovered measles patients seems to give a fair measure of protection. Equally important, however, are less dramatic hygienic measures.

Measles spreads more rapidly in congested districts and in homes where the hygiene is poor, two New York City physicians, Drs. Samuel Karelitz and Bela Schick, the latter of diphtheria test fame, have just reported to the American Medical Association. They class as homes of good hygiene those in which the sick child is isolated from other children at an early stage of the disease.

A study was made by these physicians of 106 children who had been exposed to measles. All had been exposed to the disease for from two to five days. All were given convalescent serum in the same amounts. The serum gave no protection to the children who lived in homes where the hygiene was poor. It protected over half of the children in homes where good hygiene prevailed.

Eighty-three per cent. of children who were in hospitals were protected. Drs. Karelitz and Schick conclude that children coming from careless homes must be given much larger doses of measles convalescent serum if they are to escape the disease.

These child specialists also report that the degree and frequency of infection with measles, within a period of a few days, determines in large measure whether the disease will develop in susceptible children. In this respect, measles is like tuberculosis.

TREATMENT OF PNEUMONIA WITH OLIVE OIL

SUCCESS in treatment of pneumonia with olive oil has been announced by Drs. A. C. Frazer and V. G. Walsh, of St. Mary's Hospital Medical School, London.

The oil is emulsified and then injected into the veins. The high temperature of pneumonia patients dropped to normal within twenty-four hours after the oil injection and three weeks later the patients were well.

Patients suffering from septicaemia, commonly known as blood poisoning, and from erysipelas and acute rheumatism also improved after the olive oil treatment.

The emulsified olive oil injections also seem to prevent the reactions which frequently follow injection of vaccines, tuberculin and insulin, making possible the use of much larger doses of these substances.

The remarkable effect of the olive oil is considered due to absorption of the pneumonia or other germ's poison circulating in the blood. These poisons lose their potency after adhering to the fat globules of the oil.

Drs. Frazer and Walsh first conducted test-tube experiments with emulsified olive oil and the toxins of the diphtheria germ and tetanus or lockjaw. Then they investigated the effect of the olive oil on animals infected with these germs. Finally it was tried, with success, on patients.

THE RELATIVE INTELLIGENCE OF COWS AND HORSES

TEMPERAMENT differences and intelligence similarities between cows and horses have been tested at Cornell University, by Dr. L. Pearl Gardner, as part of a series of experiments on the nature of learning in man and animals. Cows not only learn as easily as horses, but remember better what they have learned. Among the six breeds of cows used in the tests, the best "milker" was also the best learner.

The learning problem for the cows and horses was to find breakfast when it was hidden in one of a row of three boxes under a black cloth. Altogether 41 cows were tested with 850 trials and 62 horses with 1,234 trials. The cows were timid and fearful. Many were so afraid that they preferred to go breakfastless rather than attack the strange thing. Although most of the horses pushed into the cloth during the first four trials, only about half the cows dared to do this. Yet when the scores were all in, it was found that both horses and cows had the same average of seven boxes opened before the cor-

rect one in 22 trials. Cows made mistakes in method of attack less frequently than horses, who often nudged the box that was already open.

Ten of the cows who had learned the problem were re-tested after a year during which they had had a vacation from the experimenting. Their retention for a year was much better than that of horses over a period of three to eight months.

PREHISTORIC "CRAB CULTURE" IN PUERTO RICO

PREHISTORIC Indians in Puerto Rico who ate so many crabs that masses of cast-off crab claws are their cultural trademark have been discovered by Froelich G. Rainey, of the Peabody Museum of Yale University. Mr. Rainey concludes that the crab eaters are the oldest known inhabitants of the island. Their painted pottery, stone tools and shell spoons were found buried in masses of crab claws.

In his report of the discovery to the National Academy of Sciences, Mr. Rainey states he found the new type of prehistoric culture while excavating a large kitchen midden near Ponce on the south coast of Puerto Rico. This refuse pile itself was typical of what well-known prehistoric Indians of the region threw into their trash. The mound consisted of oyster shells, clam, scallop and snail shells mixed with ashes and charcoal from fires, broken pottery and discarded implements. Trenching beneath this, the archeologist made his discovery of a new type of pottery, of far better fabrication than the crude ware of the shell-heap people. And with this red and white painted pottery were other clues to a distinctive and older type of life, all mixed in disintegrated crab claws.

At least two and possibly three cultural horizons can now be defined in Puerto Rico. The crab culture was followed by the well-known Arawak Indian culture, and that perhaps by a relatively recent phase to which he has discovered several clues. Extensive work in the island's interior, however, will be necessary if this late phase of Puerto Rico's aboriginal history is cleared up.

Mr. Rainey's excavations were part of the Scientific Survey of Puerto Rico organized by the New York Academy of Sciences. The work was supported by the American Museum of Natural History, the Voss Fund and the Peabody Museum of Yale.

THE NEW NATIONAL PARKS OF CHILE

EASTER ISLAND and the Juan Fernandez Islands have been declared national parks by the Chilean Government. The impressive sight of hundreds of stone portrait figures on the hillsides of Easter Island has been endangered at times by persons damaging or carrying off statues, and other relics, as well. Easter Island lies 2,000 miles west of Chile and over 1,000 miles from its nearest island neighbors. But that long haul over which any prize piece of the island's heavy art must be carried in order to get it anywhere has not always deterred collectors.

With stronger government supervision of Easter Island

and its antiquities, science can take renewed interest in clearing up the mysteries of the "loneliest inhabited island in the Pacific." Two scientific expeditions had already made the island their goal this season, in the hope of solving the riddle of the great stone faces. It is conceded that natives carved the figures, some of which weigh full 40 tons. Natives pushed and slid the stone giants from the quarry down the hillsides. But that does not explain enough. Science wants to know whether the stone faces represented gods or native residents, and why they were carved at all, and why some were little fellows in stone, and others towered over 30 feet high. Science wants to know why the statue-making stopped abruptly, as it did one day with an unfinished masterpiece still at the quarry.

Besides the statues, unique in Pacific art, Easter Island had another ancient and mysterious distinction. Its people could read and write, and in all Polynesia they were the only islanders who could. Attempts to read the writing have given only partial success. And students of man's history want almost even more to learn whether natives on Easter Island made that great invention of a writing system for themselves; or whether they brought or borrowed the invention from somewhere else. Most important of all, scientifically, if the Easter Islanders did import their writing system, from what direction did they get it? It is of great historic interest to know whether a people so remarkable was linked culturally to Indian civilizations of South America or to some Asiatic homeland.

Easter Island, now a Chilean sheep ranch, is on no beaten tourist cruise track, and is not likely to be. One supply ship a year, private yachts and occasional wandering ships touch on the shores of this island that is world famous.

Two volcanic islands, less than 500 miles from Chile, compose jointly what is known as Juan Fernandez. Both are included in the part designation, and both have natural features of interest. There are beautiful forest scenes, great ferns, streams and wild life, including fish and wild goats.

ITEMS

THE active principle of ergot, a drug once widely used in childbirth, has been isolated by H. W. Dudley, biochemist of the Medical Research Council, and Dr. Chassar Moir, London University gynecologist. Scientists have long sought to find the substance in ergot which is responsible for its effect on the uterus. The success in this search, just reported by Dr. Moir and Mr. Dudley to the *British Medical Journal*, marks the culmination of a three-year alliance of chemistry and clinical medicine. Ergometrine is the name of the newly-isolated substance. When given by mouth, it produces strong contractions of the uterus after eight minutes. Hypodermic injections start the contractions within four minutes, on the average. Ergometrine belong to the class of drugs known as alkaloids. It differs markedly from and is probably simpler than other alkaloids isolated from ergot which were thought previously to be responsible for the drug's action on the childbearing

organ. These are now finally proved not to be responsible for the drug's action. These results are said to be in accord with the findings of Dr. A. K. Koff, of the Johns Hopkins Medical School.

JELLYFISH capture and devour baby fishes of all kinds in great numbers, according to Dr. E. W. Gudger of the American Museum of Natural History, writing in the *Bulletin of the New York Zoological Society*. One specimen was kept under observation in an aquarium, and in six weeks ate a couple of dozen tiny fish. Other species can capture and devour fish much larger than themselves. One, which Dr. Gudger describes, pulled itself over its catch like a mitten over a hand. Another, in its eagerness to get its stomach around its victim, literally turned itself inside out. The jellyfish itself is not a real fish, but belongs to a much lower order of life. It consists of an umbrella-shaped body, with a fringe of long tentacles armed with paralyzing stings for capturing its prey, and a projecting mouth-like organ in the middle. Not all fish are ready victims to jellyfish. There is at least one species that can dodge in and out among the deadly tentacles, and seems to prefer thus living paradoxically in the protecting shadow of a known and familiar danger to being exposed to the attack of other fish that fear its stinging, hungry host. Yet the jellyfish's little housemate is not immune to the stings, as has sometimes been stated. Dr. Gudger cites observed cases where individuals of this species, touched by the tentacles, have been paralyzed, drawn up to the mouth, and engulfed.

DUST storms may continue in the spring, and may blow up even in summer, if the Western drought area continues unwatered, the Weather Bureau informed Science Service. There is a strip of territory, stretching from the western Dakotas southward to the Texas Panhandle, that has been practically without rain for several years. Due partly to this deadly drought, partly to ill-advised plowing up of the age-old grass cover in the war-time wheat-boom days, the soil is all dust, ready for any wind to pick up and carry away. The present season—late March and early April—is the normal time for strong wind storms. They have been blowing in the West for ages; and dwellers on the Plains have long since got used to occasional dust storms. The winds are not becoming stronger, the Weather Bureau emphasizes; there is just more dust for them to pick up. It is this overloading of the upper air with fine dust that has made it possible, this spring and last, for dust storms to reach the East, and even the Atlantic seaboard, which had not known dust before.

THE Hot Springs National Park has a new hot spring, one which will add approximately 25,000 gallons a day to the park's supply of hot waters. The spring itself is not new, but its existence underground has just been discovered in connection with excavations for the promenade development. The temperature of the spring is 148 degrees Fahrenheit. Its waters will be collected and run into the general hot water system, from which the bath-houses are supplied.

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tion of the higher plants the author has been guided primarily by the conclusions and suggestions of Professor Arthur J. Eames of Cornell University, the outstanding authority in this field, to whom he wishes here to express his sincere thanks for frequent counsel.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE SCATTERING OF LIGHT IN DUST STORMS

BLUE light during a dust storm has no necessary connection with the color of the dust itself, but is an effect of the scattering of light that strikes the microscopically tiny particles that fill the air. This explanation of a phenomenon often noticed this spring was given by Professor W. J. Humphreys, physicist of the U. S. Weather Bureau.

Daylight does not always turn blue during a dust storm, but only when the air is densely filled with particles of the right size. Then the effect is not the blue haze of distance, but a bluishness of the light falling on objects near at hand: the letters on your desk will look as though you were working at night by the light of a dim blue lamp.

The light turns blue, rather than another color, because of all the wave-lengths that combine to make up ordinary white daylight, blue is most sharply scattered upon striking a reflecting surface. Other wave-lengths are scattered also, but to a less extent than the blue, so that blue comes to predominate. A similar bluing of the light occurs when a cloud of wood smoke, which is made up of very small particles, comes between the observer and the sun.

The same phenomenon is responsible for the blue haze of distance. There are always large numbers of reflecting dust and water particles in the air, though fortunately not nearly so many as during a dust storm. Where their density is relatively low, you have to look a long way to see a blue horizon, as in the Rocky Mountains. Where the particle density is high, as it is in the East, comparatively near-by objects assume the hazy appearance that have given Eastern mountains such characteristic names as the Blue Ridge and the Great Smokies.

THE ORIGIN OF NEBULAE

ARE the great, misty nebulae seen by astronomers the ghost-shrouds of some prehistoric star which exploded as did now-famous Nova Herculis just before Christmas? Astronomers are asking themselves that question.

Dr. Gustaf Strömberg, of Mount Wilson Observatory, in a summary of exploding stars written for the Carnegie Institution of Washington, points out one case, at least, which links the appearance of nova stars with the great nebulae. Dr. Strömberg says:

"In the sky there are certain objects whose appearance and spectra are similar to those of the later stages of a nova. It is quite possible that all of these bodies have once gone through a nova stage. A peculiar case is that of the so-called Crab Nebula in the constellation Taurus. By comparing photographs taken from time to time we have found that the nebula is gradually expanding. By calculating the time required to reach its present dimensions at a uniform rate we find that the hot gas must have left the star's surface about 900 years ago. In the records there is only one account of a nova star in

that part of the sky in which the Crab Nebula is located. Chinese astronomers saw a nova there in the year 1054!"

THE SEPARATION OF THE STARS IN PLEIADES

THE Pleiades, or "Seven Sisters," are not so sisterly as their name might indicate. New measurements with the world's oldest photographic telescope show them to be moving apart, going their separate ways, despite current astronomical ideas to the contrary.

This discovery was announced by Professor Jan Schilt, of the department of astronomy of Columbia University. It is the result of the comparison of photographic plates made 67 years ago with similar plates made recently. The angular motion between the six visible and many lower-magnitude stars composing this familiar group is so small, however, that Professor Schilt likened it to the movement in 100,000 years by an insect on 42nd Street, New York City, as it would appear to an observer on top of the Chrysler Building.

To make the new set of plates duplicate the old as nearly as possible, Professor Schilt resurrected from a museum the old telescope originally used. It was made in 1868 by a Mr. Rutherford, an old-time trustee of Columbia University, and had long since been retired from use. However, with a new plate holder and specially made plates to give as nearly as possible the same effects as the old plates, it functions as well as ever.

THE AUTOGIRO FOR PRIVATE FLYING

PRIVATE flying for every one becomes a step nearer with the announcement by the Bureau of Air Commerce that contracts have been awarded for a "jump-off" wingless type autogiro which needs a minimum of space in which to land and take off. Having rotor blades in place of wings, the trick of controlling the pitch of these rotors enables the autogiro to "jump" into the air some twenty-five feet and thus rise above the level of low trees and houses before starting its forward flight. Moreover, the folding back of the rotor blades parallel to the fuselage makes it possible to taxi the machine like a motor car and store it in a backyard hangar.

Paralleling research on private planes in America is England, where the Kay gyroplane has been finished and awaits tests. By controlling the rotor blade angle within eight degrees pitch the Kay machine can be made to take a negative angle and make it "hug" the ground when high winds are blowing at take-off.

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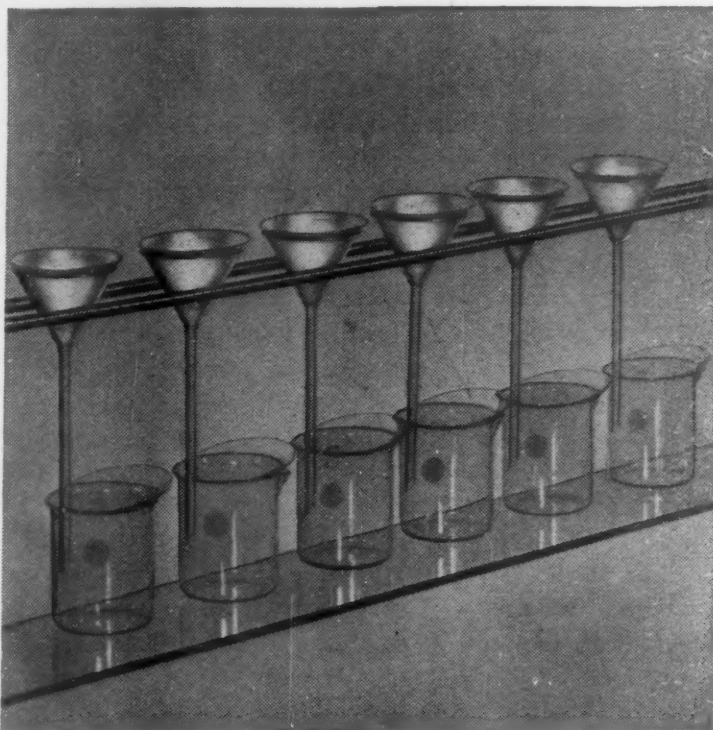
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Climbing and diving in the Kay gyroplane is a curious change from the normal airplane technique of pushing the "stick" forward to dive and back to climb. One has to remember that, in addition to the elevator controls on the tail of the plane, the tilting of the rotor to the left makes the nose go down by gyroscopic action, while tilting the rotor to the right brings the nose up sharply. Patented hubs for the rotor blades adjust these forces automatically and make the actual flying of the machine somewhat less complicated than a written description might seem.

And finally, because the Kay gyroplane does have wings, it can be flown, landed or taken off as a normal airplane.

ALCOHOL IN GASOLINE

GASOLINE will be mixed with alcohol made from surplus farm products in a number of states in the West, if pending legislation fares generally as well as it has in South Dakota, where a bill to that end has already passed both houses of the Legislature. No national legislation on the subject, however, is at present contemplated, so far as is now known. Among the states where "power alcohol" legislation is now under consideration are Iowa, Minnesota, Nebraska, Idaho and California. Other grain belt states are said to be preparing to join the procession.

The proposal to encourage addition of alcohol (usually ten per cent. by volume) to gasoline, either by direct legislative requirement or, more often, by favoring tax differentials, has been agitated for some years. The claim is made by the proponents of the idea that with present engine construction and carburetor adjustments motor vehicles and tractors can use to advantage gasoline containing up to twenty per cent. of alcohol. Farm organizations have a stake in the legislation, since it promises a profitable way of using up surplus produce, especially off-grade grain unsuitable for feed or market and cull fruits and vegetables unfit for food.

Advocates of the various state bills declare, for example, that there is sufficient off-grade corn and wheat to supply the whole power alcohol need in the grain belt without having to draw upon the marketable grains at all. Even in California, where oil is produced in great quantities, the fruit-growers are interested in finding a large-scale industrial use for their culls.

The situation in Idaho is peculiar. The famous "great big potatoes" of that state sometimes get too big. They grow too fast and split, and would usually rot if shipped. At present these outsize potatoes are sheer waste. Promoters of the power alcohol idea declare that the alcohol obtainable by fermentation of these waste potatoes will come close to filling the state's fuel requirements, while the solid residue left in the vats will supply a nitrogen-rich "finishing" feed needed by the cattle industry, which now has to buy large quantities of other feeds of this class outside the state. A third product, the gas carbon dioxide, compressed into "dry ice," is counted on to aid in the shipment of Idaho-grown apples by truck.

In order to use gasoline with alcohol, the latter must be thoroughly dehydrated. Water prevents alcohol from

blending properly with gasoline. Complete dehydration used to be an expensive process, but now several methods, operable on a commercial scale, are in common use.

BACTERIA IN THE HUMAN BODY

DR. LARS F. GULBRANDSEN, of the University of Illinois College of Medicine, has found that within a few minutes after birth, the blood and every normal tissue of the body are constantly invaded by the ordinary bacteria or "germs" found on the skin and in the mouth and nose.

This discovery upsets the prevailing idea that the blood and tissues of the body are as a rule sterile, that is, free from "germs" or micro-organisms. Dr. Gulbrandsen finds the "germs" present in a changed form and believes that this change constitutes one of the body's major means of defense against disease. So far there has not been time for other investigators to confirm Dr. Gulbrandsen's findings and theories, but his study is said to open a new field in the investigation of disease and resistance.

The bacteria or "germs" come to the tissues through the wall of the intestinal tract from food that has been taken through the mouth, Dr. Gulbrandsen believes. New-born guinea-pigs, he found, did not have bacteria in their body tissues at birth. But within fifteen minutes after feeding them pure cultures of bacteria by mouth, the micro-organisms could be found in the animal's tissues. The bacteria, however, had undergone decided changes of a type known to bacteriologists as dissociation changes. They had no power to produce disease in the healthy individual and would not grow under ordinary cultural conditions. It is this dissociation change which Dr. Gulbrandsen believes constitutes one of the body's major mechanisms of defense against disease.

Further work is being done to learn whether the bacteria pass through the lining walls of the intestinal tract intact or whether they are changed in that passage and can then return to their original form in the body tissues.

For this research Dr. Gulbrandsen was recently awarded the \$500 Capps prize of the Chicago Institute of Medicine. This prize is given each year for the most meritorious medical research by the graduate of a medical school in Chicago completed within two years after graduation.

EMOTIONS OF THE CHIMPANZEE

WHEN you see an animal "movie" and think the chimpanzee is laughing uproariously at the pranks of his pals, he may actually be howling with pain or roaring with rage.

The chimpanzee, so like man in many respects, has a very different way of betraying his emotions in facial expression. How misleading the ape's expressions are to human judges is revealed by experiments conducted at Columbia University by John P. Foley, Jr., of the department of psychology.

When the chimpanzee sees a cat or a dog, or when he is punished, his mouth opens wide so that not only the teeth but also the gums are visible. The upper part of the face becomes deeply wrinkled, the eyes narrowed,

and the brows drawn together. He's exhibiting simian rage but many humans fail to recognize it.

A photograph of the face of a chimpanzee with such a typical expression of rage was shown to 127 college students who were asked to name the ape's emotion. Nearly half the judges, 61, or 48 per cent., thought the chimpanzee was displaying joy or laughter.

Movie directors of animal films have observed and take advantage of this human tendency to misjudge chimpanzee emotion, Mr. Foley found. He cited the filming of "School Pals" as an example.

"At the conclusion of this picture, when the chimpanzee had just 'played a trick' upon his adversary, it was desired to convey to the audience the impression that the chimpanzee was laughing," Mr. Foley wrote in his report to the *Journal of Social Psychology*. "The animal's hand, hidden from direct view behind a board fence, was pinched or otherwise painfully stimulated. This immediately elicited the typical facial expression of rage or anger, which was interpreted by the audience as joy or laughter."

Laughter is in reality never engaged in by the chimpanzee. When pleased, he does have a sort of smile with open mouth, and a sort of panting is heard. But the photograph of this facial expression of joy was interpreted by the greatest number of the human judges as betokening rage. The sad, grieved animal was judged to be showing interest and curiosity, and the animal showing contentment was judged to be sad.

When questioned about the method they used for judging the emotions shown in the photograph, the majority of the judges said they compared them with human expressions. It is this tendency to assume that the chimpanzee is like the human in facial expression that seems to lead to the errors of interpretation. Others, 29 of the 127, made their judgments by taking on the expression shown in the photograph and then judging their own feelings. "I tried to imagine how I'd feel with that expression on my face, but I was handicapped because I'm not a chimpanzee," one person said.

ITEMS

RAINS, though light, have "gnawed off" the northern end of the Western drought's "bone." While dust storms have raged over the utterly rainless lands of eastern Colorado and western Kansas and on southward into the Texas Panhandle, spring precipitation has been making Montana and the Dakotas, if not exactly garden spots as yet, then at least again possible farm and ranch lands. This is one of the optimistic notes brought out in last week's weather and crop survey of the U. S. Weather Bureau. While subsoil moisture is still deficient, and drought thus liable to return if summer rains fail, still any gain in the West is cheering to the watchers of crop weather. Over the country generally the weather has been abnormally warm. In the East and Southeast, the "plus-departures" were from 9 to 16 degrees, in the upper Mississippi-Missouri area the thermometer ranged from 16 to 20 degrees above normal, while over the Great Plains temperatures were "high" by from 10 to 15 degrees. All this has been distinctly encourag-

ing to farm work, except in places where there was too much rain, as in the lower Ohio Valley and in parts of Oklahoma, Arkansas and North Dakota.

CHILDREN from the northeastern section of the United States are, on the whole, the largest and those from the western section are smallest, officers of the U. S. Public Health Service found in a study of body build of children throughout the country. The study was limited to children of native white parents and grandparents, living in four different sections of the country. The northeastern section included the New England and middle Atlantic states and the western section was limited to Utah and Nevada. Second largest children were found in states bordering the western Great Lakes. Next smallest were the children in a south central section extending from Kentucky to Texas. The stockiest children come from the northeast section; those of intermediate build from the north-central and south-central regions and the least stocky from the western area. Differences in weight between children of the same age and sex in different regions were greater than differences in height. Fourteen-year-old boys from the Northeast weighed on the average nine pounds more than those from the West but were only about an inch taller.

THAT moccasin venom, injected under the skin, controls various types of bleeding successfully is reported by Dr. Samuel M. Peck and Dr. Nathan Rosenthal, of Mount Sinai Hospital, New York, in the forthcoming issue of the *Journal of the American Medical Association*. Admitting that moccasin snake venom is a promising treatment to control bleeding, the American Medical Association warns physicians to use caution, even in experimental use of the powerful poison. Unfortunately, this snake venom is said to have no influence on the particular problem of hemophilia.

WARNING against the indiscriminate use of acetylsalicylic acid, or aspirin as it is commonly called, was issued by the American Medical Association. Aspirin is potentially a dangerous drug, is the verdict of the association's council on pharmacy and chemistry, which investigates new remedies as they come on the market and also the claims made by manufacturers for both new and old remedies. If aspirin is to be used as a home remedy it should first be prescribed by the family doctor whose knowledge of the individual's personal characteristics can alone make its unqualified use safe and advisable. Both direct and indirect harm can result from its use.

A NEW aid for diagnosis, a means of viewing a patient in three dimensions by x-rays, has been invented by Dr. O. Russo, physicist at the State Roentgen Institute, Moscow, U. S. S. R. Ever since x-rays were discovered physicians have sought some means of studying the human body with a depth perspective. X-ray photographs provide only two dimensions but have permanency. The fluorescent screen tells the same information but only while the x-rays pass through the patient's body and strike the screen.

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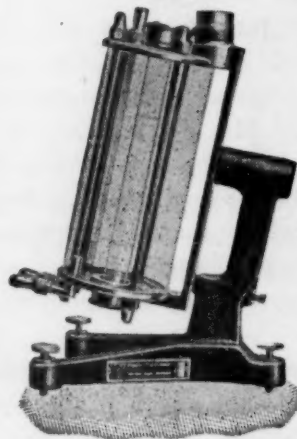


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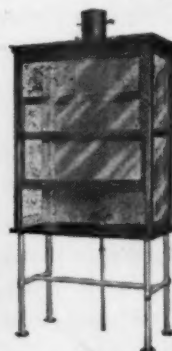
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SCIENCE NEWS

Science Service, Washington, D. C.

HEAVY OXYGEN WATER AT MANCHESTER UNIVERSITY

WHAT is probably the world's rarest liquid, "heavy oxygen water," is now being produced at the University of Manchester by means of a recently constructed diffusion apparatus.

Only a few drops of heavy oxygen water exists. The new apparatus in which J. B. M. Herbert, lecturer, and Professor M. Polanyi, of the university, demonstrated the production of heavy oxygen water is designed to produce 20/1000ths of a gram of water per day, which is about four tenths of a drop.

One atom out of every hundred of the oxygen atoms in heavy oxygen water has a mass of eighteen instead of the usual mass sixteen of ordinary oxygen. In ordinary water the normal proportion is about one in 500. Concentration of the heaviest oxygen is considered a real achievement, since the difficulties are much greater than in separating the famous three kinds of hydrogen recently discovered.

Professor G. Hertz, of Berlin, made the world's first sample of heavy oxygen water and presented the precious ten drops (half a gram) to Professor Polanyi, who was formerly professor of physical chemistry at the Kaiser Wilhelm Institute. The isotopes or atom varieties of neon, gas now used in electric signs, were also separated by Professor Hertz.

The apparatus for producing heavy oxygen water is very complex and consists of nine mercury vapor diffusion pumps circulating gas through porous clay called steatite. The very slight difference in weight between the light and heavy oxygens in the water vapor makes the concentrating process slow and tedious. Even compared with its use upon gases like neon, the process is slow because the water vapor condenses upon the surfaces of the clay tubes.

In an exclusive interview, Mr. Herbert explained to a representative of Science Service that higher concentrations of heavy oxygen water could be obtained either by repassing or by using a larger number of diffusion units. Five per cent. concentration is obtainable by the use of diffusion. By a combination of methods, Mr. Herbert believes that in time pure 100 per cent. heavy oxygen water might be obtained. But it would probably take years to achieve this goal.

Professor Polanyi is at present in Moscow where he is consulting with Soviet scientists engaged in similar work.

NEW MEASUREMENTS FOR THE ATOMIC WEIGHT OF HYDROGEN

NEW weighings of the atoms just completed at the University of Cambridge by Dr. F. W. Aston give confirmation of the announcement made to the Royal Society recently by Lord Rutherford and his colleagues that some of the weights of common elements need revision.

Using a partially completed mass spectrograph or

atom weigher, Dr. Aston announces in a letter to *Nature*, the following masses: For hydrogen, 1.0081; for deuterium or hydrogen of mass two, 2.0148; for helium, 4.0041; for carbon, 12.0048. The famous Aston value for light-weight hydrogen determined by him in 1926 was 1.0078, contrasted with the new value of 1.0081.

What has happened now is as though the official pound weight of a nation were found to be slightly inaccurate. The weights of atoms are referred to the weight of oxygen taken as 16, either as it occurs on the average in nature or as the lightest of the three varieties, depending upon whether the determination is by chemical or physical methods.

Professor M. L. E. Oliphant, A. E. Kempton and Lord Rutherford, working in the Cavendish Laboratory, first suggested the need of revision as a result of the energies with which bombarded atoms artificially disintegrated. The distances the particles shoot out from the exploding atoms allow calculations of the masses of the atoms.

Dr. Aston admits that these disintegration experiments as atom weighers are "much more delicate but less direct." Dr. Aston's new atomic weights are as yet provisional and in no case does he claim greater accuracy than one in 10,000.

Scientists are interested in the slight differences in atomic weights discovered because they are of large importance in computing the energy within atoms and developing theories as to the existence of isotopes or varieties of atoms.

"I am never likely to regret the underestimate of hydrogen's atomic weight that I made in 1926," Dr. Aston said, "however serious it may ultimately turn out to be, because of the fundamental part it played in encouraging the search for heavy weight hydrogen (called deuterium) which was discovered in America."

The discovery of deuterium recognized by the recent Nobel prize award to Professor Harold C. Urey, of Columbia University, resulted from the supposed discrepancy between the atomic weight of hydrogen determined by chemical and physical means after it had been discovered that oxygen, the standard element, was actually triplets instead of just a single element. If Dr. Aston had arrived at the present value of hydrogen's mass earlier, the successful search for heavy hydrogen might never have been started.

A NEW METHOD FOR STUDYING THE STRUCTURE OF THE BRAIN

A NEW anatomic method for studying the intricate structure of the human brain has been developed by Dr. Joshua Rosett, professor of neurology at Columbia University and scientific director of the Brain Research Foundation, and is now being used in his laboratories at the College of Physicians and Surgeons.

The first step consists in what its inventor calls "automatic internal dissection." Instead of using a knife to cut cross-sections of the brain for study, the brain

is literally exploded, blown apart into natural layers, instead of artificial sections.

The cerebrum is fixed, the covering membranes removed and the specimen wrapped in gauze and many layers of bandages. It is then placed in a steel, air-tight container, strong enough to withstand several pounds of gas pressure. The container is connected with a tank filled with liquid carbon dioxide gas.

The specimen is subjected to the high pressure of the gas, which gradually dissolves in the fluids of the brain in one or two days. The valve of the container is then quickly opened. The sudden removal of the pressure explodes the tissue, which is, however, held together by the bandages.

Instead of becoming disintegrated the brain is dissected into a great number of layers along the natural lines of cleavage. To use a homely analogy, imagine the brain substance, before being exploded, to be as homogeneous and compact as that of a turnip, in which no layers are discernible, and after explosion, to have somewhat the formation of a cabbage. The numerous layers automatically dissected by the explosion, and corresponding to the leaves of the cabbage, can then be separated by hand with great ease.

After this they are flattened between plates of glass, fixed in that position, sectioned along the flat planes, stained and mounted on glass slides. The result is that when the microscopic preparations are made the nerve fibers of the cerebrum can be traced from end to end, which is impossible by any of the cross section methods hitherto employed.

THE RÔLE OF HORMONES IN THE DEVELOPMENT OF THE EMBRYO

ATTEMPTS at ectogenesis or "babies born in a bottle" have been checked, temporarily at least, because certain hormones necessary to the early growth of the egg and embryo act only indirectly through the mother's tissues.

Discovery of how these four essential hormones act was made by Professor Gregory Pincus, of Harvard University. Professor Pincus's success in fertilizing rabbit eggs in a test-tube, announced last year, attracted wide notice as a first step toward ectogenesis, a process long dreamed of by romantically-minded scientists. In this earlier experiment the eggs were fertilized in a test-tube and then brought to birth in the body of a foster mother rabbit.

His latest efforts were directed toward the next step, continuous growth of the eggs and embryos outside the mother, a feat as yet unaccomplished by scientists. Professor Pincus tried to do this by adding certain gland products to the material in which the eggs were placed for growth outside the mother's body.

These are thyroid and pituitary hormones which affect the maturing of the egg in the ovary; oestrin, a primary female sex hormone affecting the later growth of the eggs; and progesterin, a female sex hormone affecting the growth and implantation of the eggs in the walls of the uterus.

Allowing the egg to develop normally and removing it from the mother's body after it had become implanted on

the walls of the uterus, Professor Pincus succeeded in keeping the embryo alive in a culture dish for about forty-eight hours. At this stage blood vessels began to form and the heart began beating, but all attempts to keep the embryo alive beyond fifty-six hours after separation from the mother failed.

Adding to the culture the hormones which brought the embryos through the same periods in the mother's body was also unsuccessful.

From the fact that the cultures still died at the same critical points, even after the hormones had been added to their nourishing growth medium, Professor Pincus concluded that the hormones act on the eggs and embryos through the maternal tissues rather than on the eggs directly.

ITEMS

RADOSODIUM, as a possible substitute for natural radium in yielding radiation useful in cancer treatment and industry, is now being produced "in somewhat greater quantities than reported several months ago" when Professor Ernest O. Lawrence, of the University of California, made known his discovery. Because sodium as a constituent of common salt is one of the most common things in our daily life and because salt solution can easily be injected into the blood stream, it is expected that the new radiosodium will have practical applications in the future. Professor Lawrence makes radiosodium by bombarding sodium with the charged hearts of double weight or heavy hydrogen, called deuterons. When the deuterons are flung with an energy of 1,750,000 electron volts, sodium gamma rays are given off from the new radiosodium formed with energies of 5,500,000 electron volts. These are the most penetrating gamma rays. Even more important, the radiations continue to be given off for fifteen hours.

POTASH from the waters of the Dead Sea in Palestine has now reached a production rate of between two thousand and three thousand tons a month. The initial rate, only two years ago, was not more than one thousand tons a month. The principal by-product of the potash industry is bromine, which now equals 74 per cent. of the total British requirement for this chemical. Other by-products in economic prospect are potassium sulphate and calcium sulphate, both meeting fertilizer needs of Palestinian soils.

SKULLS are not the infallible indices to race which they were once thought to be, according to Dr. Aleš Hrdlička, curator of physical anthropology of the Smithsonian Institution. They change in shape and relative dimensions within a few generations if the life environment of a people changes. From a study of a large series it will be found that there is no such thing as a line of racial discontinuity; they grade off insensibly into other skull types in all directions. Assertions that the Scandinavian region was once inhabited by a negroid people, and that modern Eskimos are like Europeans of 14,000 years ago, based on the study of skulls, are characterized by Dr. Hrdlička as erroneous.

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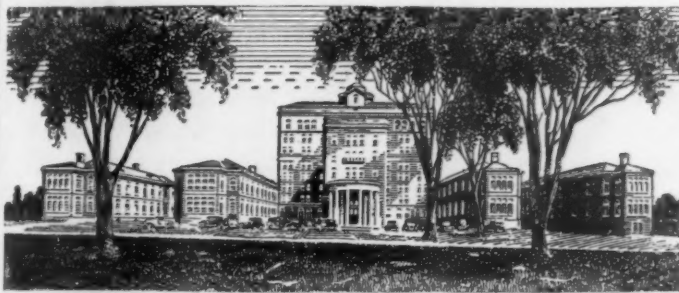
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SCIENCE NEWS

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PAPERS PRESENTED AT THE DETROIT MEETING OF THE FEDERATION OF AMERICAN SOCIETIES OF EXPERIMENTAL BIOLOGY

A NERVE fiber can not carry a second nerve impulse within an interval of about a thousandth of a second following a previous impulse, Drs. Hallowell Davis and A. J. Derbyshire, of the Harvard Medical School, reported at the meeting in Detroit of the American Physiological Society. This "refractory period" explains the mechanism of auditory masking, they said. They investigated the electrical activity of the ear and of the hearing or auditory nerve of the cat when the ear is stimulated by two sounds simultaneously such as musical tones and sharp clicks. Just as the click would interfere with hearing of the fainter musical tones, the electrical disturbances which signal the passage of nerve impulses in the ear of the cat show masking of one sound by the other. If the click falls immediately after the sound wave of the musical tone it will be masked. If it falls just a trifle earlier, the click will set up nerve impulses and be heard and one wave of the musical tone will be lost. If the two sounds compete in this way for the same nerve fibers, one or the other will be masked to a certain extent, depending on which one succeeds in first exciting the nerve fiber. In the sense organ of the inner ear, there is no evidence of any such masking. Both sets of sound waves are represented simultaneously in the activity of the sensory cells, just as they are carried through the air as complex sound waves.

EVIDENCE that the stimulus to the nerve of hearing is chemical and not electrical was presented by Drs. A. J. Derbyshire and H. Davis, of the Harvard Medical School. They examined the electrical phenomena which are produced in the ear by the sound of a click. This stimulus produces two well-known responses, they found. One is developed by the sensory cells in the ear when they are subjected to the mechanical pressure of a sound wave. The other is the electrical change associated with the nerve impulses in the auditory or hearing nerve. They found that this impulse in the auditory nerve travels at the rate of about 60 miles an hour. Even after accounting for the time for the impulse to travel along the auditory nerve, however, they found a delay of 5 ten-thousandths of a second between the response of the sensory cell and the start of the impulse along the nerve. This delay could not be explained by the theory of stimulation by the electrical response of the sensory cell.

EVIDENCE that rage is not concerned with the adrenal glands alone but may occur with all its outward signs quite independently of adrenal gland action was presented by Dr. N. B. Taylor, C. B. Weld and J. F. Sykes, of the University of Toronto. According to one theory, when a situation arises to provoke anger, the adrenal glands pour out into the body large quantities of adrenalin which in turn leads to tensed muscle, glaring

facial expression and other signs of rage in man and lower animals. It was found that the same signs of rage could be provoked by stimulating the brain by a drug called ergotoxin while the nerve supply to the adrenal glands was cut. In this case, the signs of rage were due to the abolishing of certain inhibitions of brain and central nervous system.

A DIET containing large amounts of starches and sugars may become an important part of the treatment of liver disease, particularly when the patients must undergo surgical operations. Experiments suggesting this were reported by Drs. J. L. Bollman and F. C. Mann, of the Mayo Clinic. A fatty liver, they found, can not properly do its important job of protecting the body from poisons, but the fat in the liver can be rapidly decreased by adding generous amounts of starches and sugar to the diet. The composition of the liver can be varied within wide limits by diet. Eating excessive amounts of fat increases the fat in the liver from a normal value of about four per cent. to twenty or thirty per cent. within three weeks. In extreme cases almost half the liver may be fat. At the same time there is a decrease in the amount of water and glycogen, which is the form in which the liver stores sugar.

EXPERIMENTS showing that the brain gets its energy for thinking from glucose or sugar were reported by Drs. H. E. Himwich and J. F. Fazikas, of Yale University. The brain takes sugar from the blood, breaks it up into simpler chemical combinations, and burns the lactic acid thus obtained to get energy just as a steam engine gets its energy from burning coal. Dr. Himwich and his associate found accidentally that when nicotine is mixed with brain tissue in a flask, the brain can not burn lactic acid but the burning (oxidation to the chemists) goes on just the same if glucose is present. So it appears that the brain has two ways of getting energy for thinking from glucose or sugar. Ordinarily it gets the energy *via* lactic acid, but if this is impossible, it gets the energy directly by burning the glucose. The amount of nicotine that gets to the brain when a cigarette is smoked, however, is probably too small to affect the burning of lactic acid. Incidentally, nicotine is not responsible for the increased sugar in the blood caused by tobacco smoking, according to Dr. Ephraim B. Boldyref, of Battle Creek Sanitarium.

ENCOURAGING results from treatment of diabetes by x-raying the pituitary and adrenal glands were reported by Drs. B. O. Barnes, W. L. Culpepper and J. H. Hutton, of Chicago. The results were obtained with dogs that had diabetes as a result of removal of the pancreas. One of the physicians had previously found that x-ray treatment of pituitary and adrenal glands improved the condition of human patients suffering with diabetes. Dr. Barnes reported last year that diabetes experimentally produced may be markedly improved by removing either

the pituitary gland, at the base of the brain, or part of the adrenal glands that lie atop the kidneys. Naturally, this drastic procedure can not be used in the treatment of diabetes in human patients. In these experiments, diabetes was produced by removal of the pancreas and the animals were given enough insulin to correct the diabetes. After a control period, x-ray treatments were given and it was found that with these treatments the animals needed much less insulin. The x-ray treatments apparently had an effect similar to removal of the pituitary and adrenal glands.

RICKETS—PREVENTING vitamin D is of great benefit in the treatment of arthritis or rheumatism, as it is sometimes called, according to Dr. C. I. Reed, of the University of Illinois College of Medicine. Seventy out of one hundred arthritis patients treated by himself and associates, Drs. M. L. Hathaway and H. C. Struck, were definitely helped and some apparently cured. The vitamin was given in the form of concentrated viosterol and enormous doses were used. While three thousand units is the standard dose for the treatment of rickets, Dr. Reed used one million units and in some cases three million to treat the arthritis patients. All kinds of arthritis except that due to gonorrhea were helped.

MATERNAL instinct is affected by hormones. It can be aroused in virgin rats by daily injections of prolactin, according to a report made by Drs. Oscar Riddle, Ernest L. Lahr and Robert W. Bates, of the Carnegie Institution of Washington. Prolactin, the hormone that arouses the fundamental maternal instinct, is produced by the powerful and important pituitary gland at the base of the brain. Besides arousing the maternal instinct, prolactin stimulates the production of milk in animals that nurse their young and of crop milk in pigeons. Prolactin has another remarkable action. When injected into adults, it reduces the size of the male sex glands. The largest dose reduced these glands to about 8 per cent. of their original size. A female sex hormone from the pituitary gland, on the other hand, increased the size of the male sex glands up to 65 per cent. above that of the normal adult size of these glands.

THE dryness of extreme thirst is apparently only relative, no matter how it feels, for even during extreme thirst a measurable amount of saliva is secreted. Experiments showing this to be the case were reported by Dr. Erma A. Smith, of the Iowa State College. According to previous theory, the feeling of thirst is due to dryness of mouth and throat resulting from lack of saliva. Dr. Smith's experiments seem to show that this is not the case. Dr. Smith first measured the saliva secretion during a control period in a series of normal adults. Then she gave them several ounces of a saturated solution of common salt, and continued to measure the saliva during the following thirsty period. In some persons the flow of saliva was diminished; in others it was increased; in none did it cease. From this she concluded that a measurable flow of saliva and extreme thirst occur simultaneously.

THE discovery of a hitherto unknown protein material in food absolutely essential to growth and life was announced by Dr. William C. Rose, of the University of Illinois, to the American Society of Biological Chemists. It is No. 22 in the list of the known amino acids in the proteins of the body and No. 8 in the list of those that have been shown to be necessary to life. Scientifically its name is: Alpha-amino-beta-hydroxybutyric. The newly found amino acid was discovered, identified and prepared synthetically by Dr. Rose and his associates, Dr. H. E. Carter, Richard H. McCoy and Miss Madelyn Womack of the physiological chemistry staff. About five years ago, in attempting to learn which were necessary to life, Dr. Rose and his associates fed animals a mixture of foods containing no protein but to which had been added all of the 21 amino acids then known. The animals receiving such a mixture declined rapidly in weight and eventually died. This was interpreted as indicating the presence in proteins of a hitherto unknown component which was essential to life. With that in mind a search began for the substance in question. The search was rewarded with the recent isolation of this new acid. When it and the 21 previously known acids are added to an otherwise normal diet, but one which lacks proteins, normal growth and weight are produced. This is the first time on record that animals have grown on mixtures of highly purified acids in place of proteins.

A DRUG that will sober-up intoxicated dogs was reported by Professor R. N. Harger and H. R. Hulpieu, of the University of Indiana School of Medicine, at the meeting of the American Society for Experimental Pharmacology and Experimental Therapeutics. The drug is a yellow powder known to chemists as dinitrophenol. It has recently been used to cause fat people to lose weight. Because it is very dangerous when used without a physician's supervision, the Indiana scientists particularly warn the public not to use it as a home remedy after a spree. "Severe poisonings and several deaths have resulted from its rather wide-spread use by overweight people." The experiments showed that the drug enabled the dogs to burn the alcohol they had been given much more rapidly than the usual rate. While the drug produced some fever in the dogs, which caused them to breathe more rapidly, very little of the loss of alcohol was by way of the lungs. Other investigators have shown that the body can burn alcohol only at a fixed rate and that exercise, exposure to cold and similar conditions will not speed up the burning of alcohol by the body. This discovery is the first example of any procedure which will speed up the burning of alcohol by the body.

A NEW theory of the cause of cataracts in old people and in diabetics was presented by Dr. Helen S. Mitchell, of the Massachusetts State College and Battle Creek College, Michigan, to the American Institute of Nutrition. Dr. Mitchell found that she could produce cataract in rats within two weeks by feeding them a little more than a third of their ration as galactose. This is a sugar not found as such in nature but formed in the body from

milk sugar. As a result of her studies, Dr. Mitchell believes that some cataracts, particularly those occurring in diabetes, are due to faulty handling of sugar by the body. The cataracts produced in her rats were the same kind as occur in diabetes and in old people. Dr. Mitchell emphasized that her work is only beginning and much more study is needed to solve the mystery of why cataracts form.

WOMEN are more susceptible to coffee than men. Experiments confirming this generally accepted view and showing women to be twice as susceptible as men were reported by Drs. Kathryn Horst and J. Robert Willson, of the University of Michigan Medical School, at the meeting of the American Society for Pharmacology and Experimental Therapeutics. Seven young men and seven women took part in the experiment. They drank coffee on one day of each week for several weeks and on the intervening days drank decaffeinated coffee. The amount of tremor in the index finger was carefully measured to determine the effect of the coffee. The rate or frequency of the tremor normally present was the same, no matter which beverage was taken. The amplitude or what might be considered degree of tremor, however, was increased for several hours after a single dose of coffee, but was not changed by the decaffeinated coffee. In women a strong cup of coffee containing from one and one half to two grains of caffeine produced this increase in the amplitude of the tremor, but it took more than twice this amount to produce the same effect in most of the men.

A PERSON poisoned by nicotine stops breathing because the nerve endings in the muscles of his breathing apparatus are paralyzed. The drug does not paralyze the breathing center in the brain, as has been generally believed. These discoveries, which suggest a new method of treating nicotine poisoning, were reported by Drs. Harry Gold and Frederick Brown, of Cornell University Medical College. Artificial respiration, rather than drugs to stimulate the breathing center in the brain, is the method suggested by the Cornell investigators for treating cases of nicotine poisoning in which breathing has been dangerously slowed or stopped altogether. Stimulating drugs can only make matters worse in such cases because the partially paralyzed nerve endings require rest, such as can be obtained by artificial respiration. A substance like barbitol, which has a depressing rather than stimulating effect on the nerves, can abolish the convulsant action of nicotine. An animal treated with this substance can survive an otherwise fatal dose of nicotine.

DRS. F. A. GIBBS, H. Davis and E. L. Garceau, of the Harvard Medical School, reported to the American Physiological Society that an electrical hook-up to the brain producing wavy lines traced on paper gives a new clue to what goes wrong in epilepsy. They find by this means that epilepsy is probably a neurological storm which results in great piling up of electrical discharges. The tracings of the small waves of electricity which come off from the brain are called "electroencephalograms"

and are like the now familiar electrocardiograms which give physicians information about the action of the heart. Normally these waves come off the brain at the rate of about ten per second. When a person is sleeping, in a faint, or loses consciousness temporarily in the strange sleep disease called narcolepsy, the brain waves are slowed down to about three to five per second and have about double the normal voltage. In minor epilepsy, just before and during an attack, the brain waves come off about every three seconds and in a strange pattern of large round waves with a spiky wave between the round ones. In major epilepsy both fast and slow waves of much greater than normal voltage are found. The disturbance in brain activity as shown by these tracings of the electrical waves from the brain goes on even when the epileptic patient is not having a fit or seizure and is in one of his apparently normal periods.

PROOF of the effectiveness of small doses of acetanilid in reducing fever in animals was offered by Dr. Paul K. Smith and Dr. W. E. Hambourger, of the Yale University School of Medicine. Acetanilid has been used to relieve pain and reduce fever for almost fifty years, but the proportion of a fatal dose required for lowering temperature has never before been determined. One sixtieth of a fatal dose of acetanilid suffices in rats to lessen the fever. One thirtieth will reduce the fever to normal, and one fifteenth will even lower the temperature in normal animals. It was shown that healthy animals will survive relatively large doses.

COD-LIVER oil, old-time standard rickets remedy, has not nearly so much rickets-preventing vitamin D or growth-promoting vitamin A as many other fish oils. Oils from mackerel, tuna, sea-bass and swordfish have from 100 to 400 times more of these vitamins than cod-liver oil, Dr. Charles E. Bills, of Mead Johnson and Company, reported at the meeting of the American Society of Biological Chemists. With his associates, Drs. Francis G. McDonald, O. N. Massengale, Miriam Imboden, Helen Halls, H. D. Hergert and J. C. Wallenmeyer, Dr. Bills examined the oils of 100 species of fish for their content of vitamins A and D. Three quarters of all the liver oils were more potent than cod-liver oil in vitamin D and nearly all surpassed it in vitamin A. The vitamin content of the oils varies with the zoological classification of the fish. Most potent in vitamins A and D are the fish of the order perciformi, to which belong mackerel, tuna, sea-bass and swordfish. Next come rockfishes and sculpins. Fish with soft bones contain little vitamin D and no measurable amount of this vitamin could be found in sturgeon or gray sole.

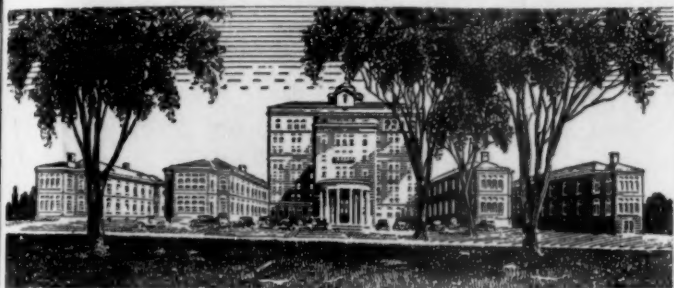
DR. WALTER SEEGER, of the State University of Iowa, reported that liver and other meat extracts lose some of their nourishing properties and are not as digestible when heat or alcohol is used in the extraction process. This is in line with the recent report from California that protein in bread becomes less digestible the longer it is cooked, and that the crust is the least digestible part of the loaf.

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SCIENCE NEWS

*Science Service, Washington, D. C.*PAPERS PRESENTED IN PHILADELPHIA AT
THE MEETINGS OF THE AMERICAN
PHILOSOPHICAL SOCIETY

THE existence of a new "scale" for weighing individual atoms that occur by the billions in a single speck of matter was described by Professor A. J. Dempster, of the University of Chicago. Dr. Dempster's atom "scale" is known to science as the mass spectrograph. Although the device itself weighs several tons, it can determine the weight of the individual atoms of the chemical elements which compose everything in the world. It is used in detecting isotopes of the various kinds of matter, the varieties of a substance like chlorine or oxygen, which are chemically indistinguishable but have slightly different weights. Secret of the delicacy of the apparatus is a system of "electric lenses" which accurately focus the electrically charged atoms of the element under study as they pass through the device. These ions have to pass through a narrow slit only one thousandth of an inch wide as they enter the "scale." After curving under the action of a magnetic field, the ions strike a photographic film and register their position. Different weight ions fall at critically characteristic positions on the film. The measurements which establish their relative weights are based on a highly accurate determination of the position of the lines. The ideal situation would be to have the lines sharp and clear, but in past instruments the lines were always wider than the entrance slit used because the ion beam was gradually spreading out like the rays from a searchlight. The "electric lenses" in the new instrument focus the various beams of different weight ions into extremely sharp lines on the film after first letting them spread out into their magnetic "weight" pattern. Using a new source of ions in conjunction with the instrument, Dr. Dempster has "weighed," for the first time in the history of science, the isotopes of gold and platinum in the pure state. The new source of ions is a highly intense electric spark which knocks out atoms from the element being studied and at the same time strips an electron from many of them, and hence gives them the needed electric charge.

THE first definite proof that there exists a super-heavy chemical element beyond the confines of the 92 chemical elements has been obtained by Dr. Aristid V. Grosse, of the University of Chicago. Dr. Grosse described before the meeting of the American Philosophical Society the production technique by which the rarest of all metals—protactinium, element No. 91, is now being obtained in pure form. In an interview with Science Service Dr. Grosse pointed out that Professor Enrico Fermi, of Italy, has revived his earlier tests for proving the existence of element No. 93 and substantiated his claims. Dr. Grosse had previously contended that the Italian investigator was really working, unknowingly, with protactinium already isolated. Because of this new test and the further substantiation of the epoch-making feat by Drs. O. Hahn and L. Meitner in the Kaiser Wilhelm Institute

in Berlin, Dr. Grosse stated that he had withdrawn his past objections. Theoretically the way seems clear for the creation of a whole series of artificially-made chemical elements previously unknown. The super-heavy elements are created by bombarding the heaviest naturally-occurring element, uranium, with neutrons. The neutrons pierce the cores of the uranium, stick there and thus increase the weights of the atoms. Although neither elements 93 nor 94 have been isolated in pure form, Dr. Grosse, from a study of the chemical properties of the known atoms, predicts that they will have characteristics associated with the two rare metals, rhenium and osmium. This means they will be extremely hard and heavy metals. Rhenium has only recently been applied to industry with the discovery of how to electroplate it on to other metals. Highly resistant to sulphuric acid, rhenium is expected to find wide use in lining tank cars and other containers for shipping this acid, which formerly was transported in glass bottles. Protactinium, which Dr. Grosse described in his report to the society, is rarer than radium. It is obtained from five tons of residue ore from the radium factory at Joachimstahl, Czechoslovakia, being worked over in laboratories at Chicago. From two tons of this ore one half milligram of pure protactinium has been obtained. So far the concentration necessary, Dr. Grosse said, was equivalent to saving only one part out of four million of the original material. Like radium, protactinium gives off alpha, beta and gamma rays, but the possible therapeutic value of the rays is yet untested. Only recently has a sufficient quantity been available to allow its distribution to medical laboratories. The alpha rays or nuclei of helium atoms which protactinium shoots off in disintegrating have energies equal to 2,540,000 electron volts—higher than those of radium. And it is much more lasting than radium, for its life period is 46,000 years where radium is only 2,500 years.

THE search for more exact determinations of the weights of atoms is meaningless in many cases at the present time, according to Professor Harold C. Urey, of Columbia University. The striking statement was made in a discussion of the ways science can separate the chemically indistinguishable isotopes of many elements such as hydrogen, oxygen and chlorine. Hydrogen and oxygen are found in common water, oxygen in air man breathes and chlorine in common table salt. What a scientist finds for the atomic weight of an element depends on how his sample of the element was prepared. If gaseous carbon dioxide is trapped in a vessel inverted over a pan of water the oxygen in the gas differs in atomic weight from the oxygen in the water by about one part in one hundred thousand. Thus the standard of atomic weight certainly can not be regarded as constant within this limit. "Atomic weights given to more significant figures will be meaningless unless the isotopic composition is specified," Dr. Urey said. "Many of the methods of determination of the isotopic composition apparently would give false results because

of fractionation in the processes involved. If these difficulties were overcome, and the exact value for the atomic weight of a given sample of an element were secured, it could not be used with certainty for some other sample unless its isotopic composition were known. Thus we must conclude that the atomic weights of many common elements, as determined by known chemical methods, are not fundamental constants of nature to more than a limited precision. This limit of precision has been reached in the case of lithium, oxygen, chlorine and, perhaps, other elements." A new method for separating the "chemical twin" isotopes of some of the lighter elements like oxygen and carbon is now being tried out at Columbia University. Known as a "countercurrent scrubbing apparatus" the device gives promise of greatly increasing the concentration. Theoretically the system yields an increased efficiency of some 800 times over methods now used. Describing the system for oxygen, Dr. Urey outlined how at the top of the apparatus carbon dioxide can be mixed with hydrogen to yield water and the gas methane. The water thus formed runs down the apparatus and at the bottom is separated into hydrogen and oxygen electrochemically. The oxygen is then combined with carbon to form carbon dioxide and passes back up the apparatus to repeat the cycle. Gradually the isotopes of oxygen are separately concentrated by this "scrubbing" technique.

DR. CHARLES B. DAVENPORT, of the Carnegie Institution of Washington, outlined a hypothesis of genic control over developing cells. Genes, he said, are believed to act as chemical catalysts to speed up the life processes, or metabolism. For the multifarious activities of each cell, guidance of hundreds, even thousands, of genes is necessary. Every time a cell divides there must be a corresponding division of genes, with a full set going to the new-formed cell. To insure this, a set of guiding threads of living stuff exists, called the chromonemata. "The genes," Dr. Davenport continued, "during the metabolic stage of the nucleus, lie usually in the nuclear membrane where the cytoplasmic molecules are attracted to them by differences in electrical charge and union with other molecules is expedited. In the adult body the nuclear genes continue their activity in connection with the manufacture of cell enzymes and other cell products."

A DRAMATIC glimpse at an entirely different angle of the reproductive process was given by Dr. Albert F. Blakeslee, also of the Carnegie Institution of Washington. It had to do with the terrific prodigality of organisms in producing microscopic bits of themselves that can be scattered abroad, so that they may "be fruitful, and multiply, and replenish the earth." In the course of his work for many years, Dr. Blakeslee said, he has had much to do with the productive processes of common fungi, especially the all-too-common mold on bread. To many persons this food-spoiling fungus seems to come from nowhere, almost to generate itself out of thin air. But it really grows from spores, one-celled microscopic reproductive bodies that function like seeds but are incalculably more numerous. As a demonstration of spore numbers, Dr. Blakeslee used a different kind of fungus, a

giant puffball found in a garden. It was a little over a foot long, ten inches wide and nine inches high. It consisted almost entirely of a mass of spores. He took one tenth of a gram of the spores—a little less than enough to fill a two-grain quinine capsule. These he mixed with water, to thin them out, and counted the spores in sample drops of measured size, under a microscope. The result of his calculations ran the spore number in this one giant puffball up to about six trillions. That would be enough, said Dr. Blakeslee, to put one spore into a sixteen-foot square on such a giant checkerboard covering the land surfaces of the whole earth. If they were confined to the United States, there would be a spore to every fifteen square feet. Theoretically, every one of these spores is capable of giving rise to a new plant of its own kind. Actually, nearly all of them fall into unsuitable places, and so perish. But considering the vast number of fungi of all sorts constantly casting their spores into the air, it is not remarkable that they turn up, apparently by magic, every time we give them any kind of a chance.

OLD women, sitting quietly in the sunset of their days, have given science an idea of how much energy is required just to be alive. Dr. F. G. Benedict, of the Carnegie Institution of Washington, told his hearers of what he had learned from his measurements of the metabolism, or basic life-rate, of 36 women between the ages of 66 and 86. They were, most of them, neither fat nor lean, neither energetic "flapper grandmas" nor "poorly in health." They were just middle-aged to old average American women. Things that speed life up for most of us had ceased for them: hard work was at an end, romance and other strong emotional stimuli were things of the past. They were just quietly and calmly alive, and that was all. For such women, specifically for those over 78 years old, an average of 1,023 calories of food-energy a day was enough, Dr. Benedict found. This is only about half as much food energy as is needed by younger women in their more active years of work, marriage and child-rearing. The caloric requirements of such women are stated variously as from 1,800 to 2,500 a day, depending on age and nature of activities. Men's requirements are even higher: from 2,200 calories a day at light work to 6,000 at work requiring extreme muscular exertion. Thus, the village blacksmith may be nearly six times as active a living machine as his aged grandmother, and even the village clerk will have double her body-fuel necessities. A calorie is basically a heat-unit. A thick slice of bread, or a lamb chop, or a dozen shelled almonds, or four small pieces of bacon, will each yield 100 calories of energy.

HEREDITY is not necessarily a fixed, unalterable, predestined pattern of events for human beings. Environmental factors, which modify hereditary behavior patterns in an individual's separate life time, may also even change the nature of the genes themselves and thus alter the course of all future heredity of the line. This, in essence, was the thesis advanced by Dr. Aleš Hrdlička, of the U. S. National Museum. Genes were defined by Dr. Hrdlička as "the molecular embodiments of heredity." Being basically chemical, they are amenable to

chemical forces, and these may be brought to bear on them by the environment. "The extraneous influences may act as stimulants, fostering the emergence or glow of heredity; as depressors or inhibitors of the same; or as damaging or destroying agencies—gene-poisons," said Dr. Hrdlička. "In general there is a mixture of these factors and the results depend on their relative strength, and on their reactions with the hereditary endowments and manifestations."

At the same session, Professor G. H. Parker, of Harvard University, told of the influence on the bodies of animals exerted by chemical substances—"neurohumors"—produced by the nerves. When a certain bundle of nerve-fibers in the tail of a fish is severed, a dark band appears, and then very gradually goes away again. The manner of its appearing and vanishing has suggested to observers that it is due to neurohumoral action. In the experiments reported the evidence was strengthened by a series of photographs taken every hour of the same region in the same fish.

PEOPLE need not worry that man will become merely a machine because of the march of science in civilization, according to Professor E. L. Thorndike, of Columbia University. There is no need for a concern of those people who think the applications of science will make man into a mere automaton and abolish free will. Speaking on the "paradox of science," Professor Thorndike explained how mankind should, for centuries to come, escape from what now seems to some to be a dilemma. Man may be part of the "machine" known as civilization, he said, but the "machine" differs greatly from machine used in the ordinary sense. The saving factor is that the parts of the social "machine"—the people themselves—can change the workings of the machine and even its construction. Science seeks to learn the workings of the immutable forces of nature and the more widely and exactly these workings are known the more man can do with them. It is the very repeatability of natural laws which enables man to adapt them into his scheme of things or adapt himself and his social "machine" to them.

DUST storms now sweeping the West should afford science one means of finding out more about the atmosphere surrounding Venus, "veiled-planet," according to a suggestion which Dr. V. M. Slipher, director of Lowell Observatory, Flagstaff, Arizona, will make to the U. S. Weather Bureau. His plan for utilizing earth's dust storms for science would be to make airplane flights high above the dust clouds and measure the upward reflection and scattering of sunlight on the dust layers. Such information should be of value when applied to the planet Venus, which appears to have perpetual dust storms in its atmosphere. Venus is without moisture to lay such dust, which once stirred up floats continually high above the surface of the planet. That at least is the present hypothesis which Dr. Slipher would like to check with airplane dust-cloud measurements on earth. Recent observations show that the weather prediction for Mars now is "cloudy and warmer." Mars is going through what is summer for its northern hemisphere and such times are

accompanied by an increase in cloudiness. Similar measurements made in 1920 showed comparable cloudiness.

SUPERSTRATOSPHERE winds blow at 200 miles an hour. A fiery visitor from outer space, flashing into earth's upper atmosphere, that made possible the measurements of these winds at the high levels where transoceanic planes should some day fly was reported by Charles P. Olivier. A giant fireball flared through the sky over Texas and Oklahoma in 1933, striking terror into the hearts of superstitious persons. More cool-headed and scientific-minded individuals took measurements and Dr. Olivier has been busy with calculations based on them ever since. As the fireball tore overhead, 18 miles up, its long train of smoke was left behind and gradually broke into knots or clouds. The rate at which these left-behind clouds moved is a measure of the superstratospheric winds. They averaged 200 miles an hour.

ITEMS

VITAMIN B₄ apparently can prevent anemia by stimulating formation of red blood cells, according to Drs. Jean L. Kyer and Frank H. Bethel, of the Simpson Memorial Institute, Ann Arbor, Mich. The anemia in this case is not pernicious anemia but the kind known as nutritional anemia. Other parts of the vitamin B complex, which is made up of at least four vitamins, were not effective in preventing anemia, experiments with rats showed. Vitamin B₄ may play its important antianemic rôle by influencing the production of hemoglobin, the coloring matter of blood.

THE body's defensive forces for resisting invasion by disease organisms can be artificially stimulated by vaccines or similar preparations only up to a certain point. Experiments showing that there is such a limit to the body's capacity for acquiring resistance to disease were reported by Drs. Reuben L. Kahn and Elizabeth B. McDermott, of the University of Michigan, at the meeting of the American Society for Experimental Pathology. Up to a certain point the capacity of the body to resist invading disease germs may be increased by increasing the number of doses of immunizing serum or vaccine. After that point has been reached, further immunizing doses produce very little response from the body's defensive forces.

SPECIMENS of a tiny crab—only a quarter of an inch across—that forces growing coral animals to build a house for it have been brought back to the Smithsonian Institution by Dr. Waldo L. Schmitt, who has recently returned from an expedition along the northwestern coast of South America and to the Galapagos Islands. The gall-crab, as it is called, was known in the western Pacific, but had not been found east of the Hawaiian Islands. When very young, the crab attaches itself to the end of a coral branch, just as it is starting to branch again. The presence of the crab probably acts as an irritation to the coral, increasing its rate of growth. At the same time currents are set up in the water which determine the direction of this growth. The result is that the two branches fold over and come together, completely surrounding the crab in a limestone cell. There are tiny airholes by which it is able to remain alive.

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THE EARTH'S MAGNETISM AND COSMIC RAYS

THAT the lop-sided magnetism of the earth is now being used to study the nature of cosmic radiation was indicated in the address of the Abbé Lemaitre, of Belgium, before the American Physical Society meeting in Washington.

Father Lemaitre read the paper of Professor M. S. Vallarta, of the Massachusetts Institute of Technology, on the "Longitude Effect of Cosmic Radiation." Professor Vallarta, with Father Lemaitre, developed the theory of cosmic rays so well supported by scientific evidence which assumes that all the incoming rays are of a particle nature and are charged with electricity.

The earth's magnetic field, Father Lemaitre explained, is not perfectly symmetrical about the earth, but acts as if its center were about 186 miles from the ideal center of the earth. The resultant field on the outside, therefore, is a bit off-center too.

Calculations on what the magnetic lop-sided effect should be on cosmic ray intensity at widely separated points about the earth gives almost perfect agreement with experimental measurements, Father Lemaitre said. Data taken in places all around the world from zero longitude at Greenwich, England, to the Antipodes on the opposite side of the earth all fall on the new calculated curves.

There is but one set of observational data which does not fit the new theoretical curves. These data were obtained by Professor Robert A. Millikan and Dr. Victor Neher on an automatic instrument placed aboard a ship enroute from Honolulu to Sydney-Melbourne. Other data fit perfectly well, Abbé Lemaitre explained. The new report lends additional support to the idea that cosmic rays are particles.

THE TRANSMISSION OF RADIO WAVES

ULTRAVIOLET rays from the sun, combined with the sun's warming visible rays, suffice to explain the daily and seasonal fluctuations of the earth's "radio roof" or ionosphere and hence longer or shorter transmission of radio waves. This is the gist of the address presented before the recent meeting of the American Geophysical Union, by Dr. E. O. Hulburt, of the Naval Research Laboratory at Bellevue, D. C.

From earliest radio days, it has been known to physicists that the radio waves most used strike the lower side of the ionosphere and "bounce back" repeatedly. If it were not for this, they would probably be lost in space.

The ionosphere is a great region of the atmosphere so far out that the now much-publicized stratosphere is only a stone's throw upward by comparison. The lowermost of its two strata, called the "E" layer, is about 60 miles over our heads; the upper, or "F" layer, has an altitude averaging two and a half times that distance. That is the night position of the "F" layer. In the day time it rises higher and higher, until about noon one part

of it, the "F₂" layer, is some 200 miles up—less in mid-winter, considerably more in midsummer. The sun obviously has a good deal to do with this "humpity" behavior of the "radio roof," making it behave more like the top of a wind-billowing circus-tent than a respectable permanent roof.

Dr. Hulburt's observations and calculations have convinced him that the sun's effect is two-fold. First, the ultraviolet radiation charges the air molecules and other particles that may be present with electricity, causing them to fly apart and thus produce a general expansion. Second, the sun's warming rays have an additional expansive effect. The two together produce the "hump" which always "rides" the ionosphere directly beneath the sun.

Such a vast mountain of even the thinnest air naturally tends to smooth itself out by flowing away in all directions. The stream that flows westward against the earth's rotation is roiled and thrown into invisible waves. The eastward stream flows smoothly and steadily. This picture, Dr. Hulburt said, fits in well with observed radio phenomena. There are one or two radio facts that do not yet fit into the picture, and these challenge geophysicists to attempt further solutions to the problem.

SOUNDING BALLOONS AND WEATHER CONDITIONS

ULTRA-SHORT radio waves, sent by light-weight sets carried by small unmanned sounding balloons, will soon be signaling weather news from far above the clouds. Preparations for flights are now under way at the Blue Hill Meteorological Observatory of Harvard University. Tests of the apparatus have already been made by airplane. Professor Charles F. Brooks, director of the observatory, under whose supervision the research is being conducted, states that the first balloon will be sent aloft within a few weeks.

A report of progress was made before the section of meteorology of the union by Arthur E. Bent, of the Blue Hill Observatory. Equipped with sensitive instruments for the recording of humidity, air pressure and temperature, small balloons will be released to search the upper air. Their readings will be automatically broadcast from the balloon by a small compact radio sender and automatically recorded on graphs at the observatory. The exact location of the balloon, both in altitude and position, can also be determined from these radio signals.

This method of investigation has several advantages over airplane flights for the determination of weather conditions, not only from the point of economy, but also in time saving. Unlike ordinary sounding balloons, those equipped with radio can be used at coastal points where the others usually become lost at sea and are thus of no value. Mr. Bent has succeeded in constructing a complete radio-sending device for a balloon, the simplicity and low cost of which will make its probable loss of no great consequence.

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"Van Valkenburg and Huntington" should appeal to teachers of college geography in particular, as an excellent basic textbook in the geography of Europe. It is, also, suitable for use as supplementary reading material in history courses.

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An experimental assembly now being tested weighs a little more than two pounds and is audible up to a distance of 50 miles. A wave-length of five meters will be used. A small 4.5-volt C battery is used for power and works satisfactorily up to more than 20,000 feet. Higher altitudes may require a small heat-generating unit. An eight-foot wire by which the instruments are suspended from the balloon is used as an antenna.

A continuous signal will be broadcast for direction and altitude determination. A break every 60 seconds is used for timing and three other breaks per minute indicate by their spacing the air pressure, temperature and humidity. As recorded in the observatory, the readings are in the form of graphs of these variables.

A radio meteorograph for use on an airplane instead of a balloon was demonstrated by Mr. Bent, assisted by Dr. K. O. Lange, of the Massachusetts Institute of Technology, who designed the instrument for the Blue Hill Observatory. The meteorograph and its radio sender were placed on one side of the lecture hall and the indications were received and automatically recorded on a portable chronograph on the other side of the hall.

A NEW SYSTEM OF RADIO TRANSMISSION

A NEW system of radio transmission and reception which, it is claimed, will wipe out the effects of static, fading and tube noises has been invented by Major Edwin H. Armstrong, professor of electrical engineering at Columbia University. Major Armstrong predicts that the new technique will make ultra-short wave broadcasting practical, solve problems of chain television and make possible the transmission of musical sounds far exceeding, in quality, any possible at present.

Major Armstrong holds the medal of the Institute of Radio Engineers for his invention of radio regeneration and the superheterodyne and super-regenerative radio circuits.

Secret experiments have been carried on in the tower of the Empire State Building for the last year. That tests were being made was known, but the nature of the work was a closely guarded secret until now.

The fundamental point about the new system is the introduction, into the transmitted wave, of a characteristic which does not exist in the radio waves produced by nature in causing static. The receiving set is so arranged that it will pick up only radio waves having the characteristic properties and discards those from natural sources. "The principle is carried out by the use of a discarded method of modulation of the carrier wave known as frequency modulation," Major Armstrong states. "This method of modulation has been known for over twenty years, but the hitherto unsurmounted difficulties due to distortion and other troubles in both transmitter and receiver have caused its abandonment by all who worked with it." It is possible to transmit from different programs with the system. They can be simultaneously transmitted and received with a single transmitter and receiver.

The radio waves transmitted by the system are of very short wave length and do not make reception possible over

great distances as in present broadcasting. A point-to-point nation-wide chain of transmitting stations which would relay the program about the country is the present picture of future development. While the economic investment would be higher, probably, the freedom from the present troubles of static and fading offers much compensation.

A NEW WAR GAS

HAS a new war gas been discovered? Chemists at the meeting of the American Chemical Society in New York City recently were asking themselves this question as they discussed the new chemical reported in the division of organic chemistry. This chemical has a blistering action on the skin comparable with the dreaded war-time mustard gas.

Known by the polysyllabic name pronounced tri-chloro-tri-ethyl-amine, the highly irritating chemical is a new liquid compound reported by Kyle Ward, Jr., chemist of the Experiment Station of the Hercules Powder Company of Wilmington, Del. Containing 25 atoms in its highly complex molecule, the new substance was made synthetically for "raw material," as Mr. Ward described it in an interview, out of which still larger molecules could be made. Whether these still-bigger compounds were in the nature of a new, unannounced explosive, Mr. Ward was unwilling to state.

The intense blistering properties of the new liquid were discovered accidentally, when localized burns appeared on the skin of chemists making it. The liquid is not corrosive in the sense of certain fluorine compounds which can not be made in ordinary glass chemical test-tubes and beakers and must be prepared in paraffin receptacles. Routine chemical laboratory equipment suffices in manufacture of the new gas.

While Mr. Ward was unwilling to speculate on possible military uses of the blister-producing substances chemists recall that mustard gas is also a liquid and that the formula of the new substance is essentially the replacement of the sulfur atom of mustard gas by the element nitrogen.

There will be speculation on the way the new substance might be used in war-time. The most commonly mentioned picture will be that of filling shells with the substance, as with mustard gas, which on explosion will spread the liquid widely in the form of tiny, microscopic droplets in a blister-making "fog." There is at present believed to be no intention to manufacture it with any military use in view.

FIREPROOFING AIRPLANE FABRIC

A NEW technique for "doping" airplane fabric, so successful that gasoline poured on a wing can be burned off without injuring the cloth in any way, was announced at the meetings of the American Chemical Society. Dr. Gordon M. Kline, of the National Bureau of Standards, told of the new "dope" which reduces the danger of fire in aircraft to less than twenty per cent. of its present hazard.

The "dope" is regarded as highly important for military aviation, both airship and airplane, especially on the

great airplane carriers like the *U. S. S. Lexington*, where large numbers of planes are stored below decks.

The new fire-resistant treatment consists of the impregnation of the cloth fibers with a boric acid-borax mixture and then the coating of this cloth with cellulose acetate instead of cellulose nitrate as now used. Cellulose acetate burns only one fifth as fast as cellulose nitrate, Dr. Kline said. Thus the fire hazard is reduced to 20 per cent., while the fire-resistant treatment of the fibers lowers the danger still more.

At the Bureau of Standards a discarded metal-structured amphibian biplane has been burned up in tests of the new airplane dope. Gasoline was poured over the plane in the most crucial test and then ignited. Flames quickly spread everywhere but, when the gasoline burned itself out, the fabric was as good as new.

Key to the chemical advantage of the new "dope" over that now in use lies in the fact that the new acetate compound needs external supplies of oxygen to make it burn even slowly. The present nitrate "dope" supplies its own oxygen for combustion. Moreover, the acetate "dope" will only ignite at a much higher temperature than the nitrate "dope." The latter has products in it which may burn at the temperature of a hot steam pipe or electric light bulb.

ITEMS

LATE July should see, somewhere in the world, a severe earthquake with its focus, or center of motion, relatively close to the surface of the earth. That is the indication which may be inferred from a report presented before the meeting in Washington, D. C., of the American Geophysical Union, by Professor H. Landsberg, of the Pennsylvania State College. Professor Landsberg did not himself venture an earthquake forecast, but he did show a remarkably close hook-up between deep-focus earthquakes and shallow-focus quakes following three months later, as a rule in some remote part of the world. The Formosa quake of the Easter week-end was a deep-focus disturbance, its center being some 35 kilometers, or 22 miles, beneath the surface of the earth. On the basis of Professor Landsberg's correlations, a destructive shallow-focus earthquake may be expected to occur about a week before the end of July. Professor Landsberg also discovered a correlation between deep- and shallow-focus earthquakes with a much smaller time lag—some three days before and three days after the deep-focus quake.

At the meeting of the American Chemical Society in New York City Dr. Harry N. Holmes and his co-workers at Oberlin College described new developments in the advance toward the long-sought goal of complete isolation of vitamin A in 100 per cent. purity. While admitting that the goal is not yet attained they reported the production of a fluid 14,000 times as concentrated as standard cod-liver oil. This is a 40 per cent. gain over the previous world's record made in 1931 by Professor P. Karrer, of the University of Zurich, Switzerland. The Swiss concentrate was only 10,000 times as potent as the standard oil.

New facts on the structure of vitamin B₁, whose absence from man's diet causes the acute nervous disease beri-beri, were reported to the American Chemical Society by Dr. R. R. Williams, Dr. E. R. Buchman and co-workers of Columbia University. Beri-beri is prevalent among several hundred millions of peoples of the world, especially in the Orient where polished rice is a staple of diet. It produces an inflammation of the nerves, and in acute forms, a painful rigidity of the limbs. Many physicians suspect that certain types of nervous troubles of peoples in occidental countries like the United States and European nations may also be caused by a slight deficiency of vitamin B₁. Some patients appear to obtain relief by taking concentrates of the vitamin obtained from brewer's yeast. Dr. Williams and Dr. Buchman have taken the vitamin apart in their test-tubes, added atoms here and there in the complicated molecules and learned new facts about its composition. Such knowledge is preliminary to the long-sought goal of creating the vitamin synthetically in the laboratory at which time the roundabout method of concentration from yeast can be replaced by the man-made technique. Then one would be able to take pills or capsules of vitamin B₁, just as now it is possible to take vitamin C or vitamin D.

DR. PAUL R. HEYL, of the National Bureau of Standards, announced at the meeting of the American Geophysical Union that the pull of gravity which helps to determine the earth's weight will in a few weeks be more accurately known than ever before. The value as at present determined is represented by the figure 980.087, which differs somewhat from previous measurements. Dr. Heyl, who, with Dr. G. S. Cook, has been working for years on gravity determinations with a specially constructed pendulum, in a deep vault under one of the Bureau of Standards buildings, announced the work "has been practically completed, only a few weeks' work yet remaining."

By spinning a duralumin rotor in a vacuum, forces are created equal to 1,200,000 times that produced by the gravitational pull of the earth, Dr. E. G. Pickels, of the University of Virginia, reported to the meeting of the American Physical Society. Such an enormous force offers the possibility of being able to pull molecules apart. Centrifugal force 1,200,000 times as great as the force of gravity may be explained by saying that gravity makes an object dropped from a high building fall 16 feet in the first second. If the force of gravity were as large as the force in Dr. Pickels's ultracentrifuge, a dropped object would fall 19,200,000 feet in the first second, or more than 3,600 miles. Using air pressure of 50 pounds to the square inch to drive the rotor, top speeds of 156,000 revolutions each minute were obtained. At this point the rotor flew apart and the calculated centrifugal force was 1,200,000 times the force of gravity. "Photographs of molecular sedimentation in an observational centrifuge," Dr. Pickels said, "demonstrate the possibilities of the apparatus in molecular weight determinations."

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SCIENCE NEWS

Science Service, Washington, D. C.

THE HORMONES OF THE PITUITARY GLAND

Two new hormones from the pituitary gland, each a twin to already known pituitary hormones, were reported by Dr. Leo Loeb, of Washington University, St. Louis, in an address before the American College of Physicians meeting in Philadelphia following his presentation with the John Phillips Memorial Medal of the college.

The new pituitary hormones act on thyroid and female sex glands, respectively. A species difference in the extracts from the pituitary that influence thyroid and sex glands had previously been recognized. An extract from the pituitary gland of a cow has a stimulating effect on the cow's sex glands but just the opposite effect on the guinea-pig's glands.

Investigations conducted by Dr. Loeb during the past two months for the first time show that this different effect is due to the production by the pituitary of two different hormones with antagonistic effects on female sex glands. In the pituitary glands of cattle, the ovary-stimulating hormone predominates while in pituitary glands of other species of animals the antagonistic hormone predominates.

The presence of these two hormones, where only one was formerly thought to exist, may have a relation to the anti-hormone effect discovered by Dr. J. B. Collip and associates, of McGill University, who have found substances called anti-hormones in the blood of men and other animals.

Dr. Loeb's other recent discovery of two thyroid-stimulating hormones from the pituitary may throw further light on the cause of Graves' disease or exophthalmic goiter, the disease characterized by pop-eyes, rapid pulse and other disturbances. Dr. Loeb and other scientists have been able to produce all the symptoms of Graves' disease in healthy animals by giving them doses of thyroid-stimulating pituitary hormone, which suggests that disorder of the pituitary may be a cause of this kind of goiter. Dr. Loeb is now studying the pituitary glands of persons who died of Graves' disease. He hopes to find which of the two thyroid-stimulating pituitary hormones predominates in these glands, and thus which may be responsible for the development of the disease.

The pituitary gland at the base of the brain, master of all endocrine glands of the body, has another rôle. It is nature's sculptor which models the head, face and features of man. The mechanism by which the pituitary plays this newly-discovered "sculptor" rôle was described by Dr. Hector Mortimer, of McGill University, at the meeting of the American College of Physicians. Finding how the gland acts to change facial features will aid the endeavors of physicians to diagnose and treat disorders of the gland. Dentists will also be aided in their own problems of facial and palatal growth. Scientists have, for years, studied the question of the mode of growth in the human face in an endeavor to solve the question of those changes which make the Mongoloid

features so different from either the Negroid or those of the white race, the Caucasoid.

VITAMIN C AND RHEUMATIC FEVER

DESPITE recent animal experiments suggesting that lack of vitamin C in the diet might cause rheumatic fever, the vitamin is neither a cure nor a preventive of the disease and apparently has nothing to do with its cause.

First tests of the recent theory on human patients, with the above conclusions, were reported by Drs. Mark P. Schultz, Jules Sendroy and Homer F. Swift, of the Rockefeller Institute for Medical Research, at the meeting at Atlantic City recently of the American Society for Clinical Investigation.

Their studies were made on over one hundred persons. Fifteen were patients acutely ill with rheumatic fever. These were given large daily doses of the vitamin in the form of ascorbic acid by mouth and by injection into the veins and in addition large doses of orange juice. They were also given substances rich in other vitamins. No beneficial effect of this treatment was seen.

Two groups of children, about thirty in each, were examined carefully for several months beginning in mid-winter. Children in one of the groups were given large daily doses of vitamin C in the form of ascorbic acid. Although the children not receiving the vitamin developed a mild degree of scurvy in early spring, there was no difference between the groups as far as the rheumatic disease was concerned. In fact, relapses of acute rheumatic fever occurred in three children who had received the ascorbic acid daily for two to three months.

Careful tests of the use and storage of vitamin C in thirty patients and non-rheumatic persons showed in the rheumatic patients no abnormality in the way the vitamin was handled by the body nor any deficiency in the body's store of this vitamin.

The theory that lack of vitamin C and consequent development of scurvy was a factor in causing rheumatic disease was based on experiments reported by Drs. James F. Rinehart and S. R. Mettier, of San Francisco, two years ago. They produced symptoms resembling human rheumatic disease in guinea-pigs deprived of vitamin C until a mild degree of scurvy appeared. The animal experiments were repeated by a Rockefeller Institute scientist with the same results. Studies on human patients now indicate that lack of the vitamin is not important in causing the disease.

COMBINATION OF SUBSTANCES NEEDED FOR THE CURE OF ANEMIA

THE ability of liver to keep pernicious anemia patients alive and well, so long as they keep on eating or taking liver extract, does not depend on any single chemical substance contained in liver.

Experiments showing that the effectiveness of liver depends on a mixture of three active substances, two of

which have been obtained in pure crystalline form, were presented by Drs. Cyrus H. Fiske, Y. Subbarow and Bernard M. Jacobson, of the Harvard Medical School.

Since the discovery of the liver treatment for pernicious anemia, continuous efforts have been made to find the chemical substance in liver responsible for its effect on the disease. Although potent liver extracts are now available for pernicious anemia patients, if the active substance in liver could be identified, it might be made in the laboratory much as many other medicines are made, instead of having to be extracted, at considerable expense, from liver itself.

Three substances obtained from liver by chemical treatment and known as "fractions" have been found to have an effect on the blood-cell-forming organs of both patients and guinea-pigs. But in the course of chemical purification of the "fractions," they lost their anemia-relieving potency. Two of these "fractions" have been obtained in crystalline form and the chemical composition of one of them determined. Separately these "fractions" have no effect on pernicious anemia patients, but a mixture of all three of them is highly effective as a remedy for the disease.

THE REPOPULATION OF FOUR FARMING REGIONS

WARNING that the subsistence homestead activities of the Federal Government should not be directed toward encouraging migration of people to poor farming areas was the keynote of a round-table discussion at the Conference on Population Studies in Relation to Social Planning under the auspices of the Population Association of America at Washington.

The notion that the movement to the country districts since the depression has done much to correct an "over-balance of population," and has placed people in more promising locations, is contrary to facts brought to light by a survey conducted by the Study of Population Redistribution, by Dr. Carter Goodrich, director of the survey.

Since the depression, the increases of population have been particularly heavy in those farming regions that were the very worst, as measured by *per capita* farm income during prosperous years. Population increases were heavy in the most poverty stricken and unpromising areas of the cut-over country of Michigan and Wisconsin, and in the mountains of West Virginia and eastern Kentucky.

Contrasted with this movement of people back to bad farms, was the movement during the prosperous years before 1929. Then the migrations were drawing people away from those areas that have had the heaviest relief loads during the depression.

Twenty-seven of the 29 "poorest" counties in the United States, having an average of over 36 per cent. of the population on relief, and 70 of the 80 worst, having over 30 per cent. on relief, were areas that people were leaving during the prosperous twenties.

LENGTH OF LIFE AND OLD-AGE PENSIONS

THERE will be 25,500,000 people over 65 years of age in 1980. This is the estimate of those who would be

old enough to be entitled to old age pensions under proposed legislation, made by Drs. Louis I. Dublin and Alfred J. Lotka, of the Metropolitan Life Insurance Company, speaking before the Conference on Population and Social Planning.

If every person over 65 in 1980 were to receive \$15 per month as the federal share of an old-age pension, the total bill would amount to \$4,690,000,000. This is much higher than the estimate of the President's Committee on Economic Security, who figured that the maximum would be reached in 1980 at \$1,294,300,000. The committee's estimate was based on the assumption that there would be only about 17,000,000 persons over sixty-five years in 1980.

The use of a succession of life tables allowing for the lengthening of the life span and the increase of the proportion of older people in the population was urged by Drs. Dublin and Lotka in their report.

The birth-rate in the United States has declined to a point where it is too low to allow the present population to replace itself in the next generation. In the year 1920, the rate of natural increase was 5.4 per thousand. That is, 1,000 persons would be replaced by 1005.4. Since then the increase has dwindled past the zero point until in 1933 there was actually a decrease of 3 per thousand, or almost as much on the negative side as it was on the positive side ten years previously.

ITEMS

COMPLETE removal of the thyroid gland in the neck cuts the work of the heart almost in half, which explains why the operation relieves symptoms of heart disease such as angina pectoris, Dr. Mark D. Altschule, of Boston, reported at the meeting of the American Society for Clinical Investigation. The operation reduces the metabolic rate to about minus thirty per cent., and at the same time there is a forty per cent. decrease in the work of the heart, Dr. Altschule found. The thyroid gland controls the metabolic rate, that is, the rate of energy interchange in the body, and when this rate is high, indicating that the interchange of energy is proceeding at a rapid pace, there is more work for the heart to do. Removing the thyroid completely reduces the metabolic rate to a low level and relieves the heart. The theory that this is why removal of the thyroid relieves symptoms of heart disease was put forward by Dr. Herrman L. Blumgart, of Boston, some years ago. Dr. Altschule's studies confirm the theory.

SERUM tests that identify "quite definitely" the virus causing human influenza and show the same virus is the cause of the disease in different parts of the world were reported by Drs. Thomas Francis, Jr., and T. P. Magill, of the Rockefeller Institute for Medical Research, at the meeting of the American Society for Clinical Investigation. The virus was obtained from throats of influenza patients in Puerto Rico, New York and Philadelphia. The virus can be transmitted to both ferrets and mice, and in both species of animals causes consolidation of the lungs. Most of the mice die of the disease, but the ferrets usually recover. The blood serum of ferrets that have recovered can check the ability of the virus to infect mice and to produce the lung consolidation. So does

the blood serum of convalescent influenza patients, but the serum taken from patients during their acute illness does not protect the mice against the disease. This latter finding, Drs. Francis and Magill state, seems to "show quite definitely that the virus is the causative agent of the human disease."

PROSPECT of obtaining "heavy" water which will allow large scale experiments with this rare and relatively new liquid was presented to the American Chemical Society. Dr. D. S. Cryder, of Pennsylvania State College, told how heavy hydrogen can be concentrated by distillation of ordinary steam. About a trillion pounds of steam are generated annually by the U. S. power and light industry and the 2,000,000 pounds of the now-expensive liquid would result if only one per cent. of this steam had its heavy water extracted. Dr. Cryder predicted that the new Penn State method would allow production of heavy water at less than \$2 a gram, ten cents a drop, the present lowest price quoted by Norway where cheap electricity is available. The present method of concentrating deuterium-rich water is by electrolysis. Water with its hydrogen of the double-weight variety—deuterium to chemists—is useful in tracing chemical reactions which may lead to new chemical knowledge of great value to industry.

CAVIAR may be a delicacy to most people, but to children of Soviet Russia it may become a tasty substitute for cod-liver oil because, like the fish oil, it is rich in anti-rickets vitamin D. A daily dose of two teaspoons of caviar was prescribed for one month to a group of 20

babies suffering from rickets. Seventeen of the babies were completely cured by this epicurean treatment, according to a report made by Professor M. Lepsky. Caviar from sturgeon and carp-like fish was used in this experiment. The caviar of various fishes differs but slightly in composition, however, so it is possible that other kinds of caviar may prove equally effective as a cod-liver oil substitute.

CONCLUSIVE fossil evidence that an arm of the sea covered central New Hampshire for a period of from fifty to a hundred million years longer than geologists have previously believed has been found by Professor Marland P. Billings, of Harvard University, and Dr. Arthur B. Cleaves, of Lafayette College, Pennsylvania. Several hundred specimens of fifteen species of fossils positively identified as belonging to the lower Devonian epoch have been found by the two scientists in the vicinity of Littleton, northwest of the White Mountains and about ninety miles inland from the Atlantic coast. It had not been previously known that the sea in this period extended into New Hampshire, although its extension into other areas at that time had been ascertained. Fossils of the Silurian period, believed to have begun about 400 million years ago and to have continued until the Devonian epoch, have previously been found in this area and told science that the sea was there at that time, but until the present discovery, no fossils satisfactorily identified as Devonian had been found in the region. Consequently the continuance of the sea in that area for fifty million additional years was unknown.

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SCIENCE NEWS

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TELEVISION PROMISED WITHIN A YEAR

ACCORDING to an announcement by David Sarnoff, president of the Radio Corporation of America, high detail television within a year is probable in the New York metropolitan area.

The corporation will invest \$1,000,000 in the development of a transmitting station, the manufacture of receiving sets and the formation of a program service which will take the air within twelve or fifteen months.

Declaring that American television is now prepared to give fine detail pictures better than those being used in Europe, Mr. Sarnoff emphasized that the greatest need of the art to-day was to take it out of the laboratory into the field for future development.

Already pictures with 343 lines to the inch, as compared with the crude 30 lines to the inch pictures of a few years ago, are available. What one can now see with the present stage of television is "comparable with what one sees of a parade from the window of an office building, or a world series baseball game from a nearby roof, or of a championship prize fight from the outermost seats of a great arena."

Television will not compete with sound broadcasting in its nation-wide scope. The first transmission will be over a circle of not more than twenty-five miles radius. Wire facilities are not available for wide distribution and such mass-broadcasting is "not here nor around the corner."

An enormous economic sacrifice will be necessary to "put over" television, Mr. Sarnoff indicated, for each advance in the art will make obsolete prior equipment, both transmitting and receiving. The situation will not be comparable to sound broadcasting where a ten-year-old receiver may still be used if one is not too fussy about the quality. It will, therefore, not be well to have the systems of transmission or receiving standardized too soon on a wide scale if future progress is to be possible.

SOVIET BALLOONS FOR EXPLORING THE STRATOSPHERE

RECALLING former fatal disasters in their stratosphere balloon ascensions, investigators in Soviet Russia are stressing safety, then more safety, in the two new balloons now under construction for scaling the atmospheric heights above seven miles.

The *LL-1*, which turns its balloon into a gigantic parachute in case of accident, has passed rigorous tests in model form. When taken up in a balloon and released with almost no gas in the envelope, the model began to fall in the shape of a pencil, but broader at the top than at the bottom. Within two or three seconds, however, the envelope turned into a fully opened parachute. The two models used in tests each had a volume of 10 cubic meters. It is claimed that even if the envelope is torn, a safe descent is assured by a secondary parachute arrangement inside the envelope, which can be brought into operation in an emergency.

A parachute which will operate automatically should

the gondola become separated from the balloon is the chief safety device of the *Osoaviakhim-2*, the other "stratostat" planned to make a flight in 1935. In addition, many other details have been added or improved to insure safety. The new details should enable the *Osoaviakhim-2* to attain a higher altitude as well as provide greater safety for its crew, according to P. S. Dubinski, chairman of the *Osoaviakhim* (Society for Air and Chemical Defense) Committee for Study of the Stratosphere.

The balloon will be considerably larger than those of its predecessors, and, like that of the *LL-1*, will be made of rubberized cambric muslin. The upper part, from which the gondola is suspended, will be of specially reinforced fabric, and 24 cables will tie gondola to balloon. Of stainless steel, the gondola will be all-welded, and will contain two hermetically-sealed observation windows which can be opened in a few seconds in case of emergency.

CORTIN FOR WASTING DISEASE OF CHILDREN'S MUSCLES

CORTIN, the hormone produced by part of the adrenal glands and recently hailed as a life-saving remedy for usually fatal Addison's disease, may prove to be very useful in ameliorating the unhappy effects of a baffling disease of children, muscular dystrophy. Work done on several cases of progressive muscular dystrophy, hypertrophic muscular dystrophy and myasthenia gravis, in comparison with other abnormal conditions and normals, was reported by Dr. M. X. Sullivan, of Georgetown University, to the American Society of Biological Chemists.

A chemist himself, Dr. Sullivan became interested in the muscle disease when he found it was accompanied by certain changes in the body chemistry. In this disease a substance called creatine which is normally changed in the body to creatinine during muscle activity is excreted via the kidney as unchanged creatine. Investigating further, Dr. Sullivan, aided by Dr. Walter C. Hess and P. Irreverre, found that relatively appreciable amounts of guanidine are excreted in this disease, generally in a combined form readily converted to free guanidine by oxidation with silver oxide or mercuric oxide.

Guanidine is a protoplasmic poison and prevents the passage of an impulse over nerves to muscles. The muscles remain inactive and gradually waste away. Glycine, long considered valuable in checking the progress of the dystrophies, did not eradicate the simple guanidine derivatives, but did seem to check the progress of the disease more or less. In one case of a seven-year-old boy, treatment for several months with cortical extracts taken in pill form brought about changes towards normality. The wasting of the muscle which characterizes this disease was checked, the appetite improved, weight increased and the excretion of material yielding guanidine ceased.

Dr. Sullivan described a new colorimetric test which he

had developed for free guanidine not given by combined guanidines. Material yielding free guanidine he finds is excreted in muscular dystrophies, especially pseudohypertrophic muscular dystrophy, but not in a similar disease of adults called myasthenia gravis. Some possibility exists that the cortin treatment taken early may actually have curative value.

NARROWING THE ATTACK ON INFLUENZA

INFLUENZA can not yet be listed among the conquered plagues of the world, but medical scientists seem to be closing in on the foe. Latest news from laboratories where the battle now is being carried on pin the cause down pretty definitely to a virus.

Investigators at the Rockefeller Institute for Medical Research in New York City have reported that they have found the same virus strain caused influenza epidemics in Puerto Rico in 1934, in Philadelphia in 1935 and in London in 1933, 1934 and 1935. They believe their tests show definitely that the virus is the cause of the disease.

Their views are concurred in by Dr. P. P. Laidlaw, of the National Institute for Medical Research, England, who, with his associates, isolated the virus from cases during the London epidemics. Dr. Laidlaw, according to cabled reports, has stated that he believes the idea of a virus causing the disease can be considered as a provable theory.

Dr. Laidlaw also endorses the suggestion that swine influenza is the same as human influenza. This suggestion was first made after the world epidemic of 1918 by J. S. Koen who, as hog cholera control inspector of the U. S. Bureau of Animal Industry, investigated the then new disease in hogs.

"It seems indeed exceedingly probable," said Dr. Laidlaw, "that the virus of swine influenza is really the virus of the 1918 pandemic adapted to the pig and persisting in that species ever since."

Dr. Thomas Francis, Jr., of the Rockefeller Institute, in his most recent report said that his tests showed the virus of swine influenza to be different serologically from the virus of the human disease.

While this point, like many others, remains to be settled, it is hopeful to note the progress that has been made in the long, hard task of finding what causes influenza. With that point fairly settled, measures leading to prevention of the disease or to more successful treatment can be looked for.

CONGRESS PLANS HONORS FOR AMERICAN EXPLORERS

IN addition to the honors conferred upon General Adolphus Washington Greely, for his polar expeditions in 1881, Congress is considering various methods for commemorating the exploits of Hernando De Soto, Cabeza de Vaca, Henry Hudson and Leif Ericson.

Special fifty-cent pieces will probably be coined in honor of De Vaca and Henry Hudson; while, if the bill pending before Congress relating to Ericson is passed, the President will proclaim October 9 as Leif Ericson Day throughout the nation, as has already been done in the states of Wisconsin, Minnesota and South Dakota.

De Vaca was one of the five survivors of the De Nar-

vaz expedition to the North American Continent, which sailed from Spain in June, 1527. Enslaved by unfriendly Indians, De Vaca and three others finally escaped in 1535, and reached the settlements of New Spain in 1536. It is believed that they passed through the site of the present city of Alpine, Texas, and through the Big Bend country of the Rio Grande, thus opening what is known as the Old Spanish Trail four hundred years ago.

Henry Hudson, in the *Half Moon*, landed at the site of what is now Hudson, New York. This was in 1609. It was in 1785 that the city received its charter; thus the residents of Hudson have asked for the special coin to mark the one hundred and fiftieth anniversary of their city.

Ericson was a great Norse explorer, who sailed to North America in the year 1,000. He did his discovering as a side-issue, for his mission from King Olaf was to convert the colonists of Greenland to Christianity. An account by Professor R. B. Anderson, of Wisconsin, states the view that Ericson must have built a house at what is now called Gerry's Landing, not far from the present site of Harvard University.

Because of the approaching four hundredth anniversary of De Soto's expedition from Cuba to Florida, in 1539, a joint resolution has been introduced for the President to appoint a commission to make a thorough study of the subject, looking towards proper celebration of this historic event four years hence.

ITEMS

DISCOVERY in Death Valley National Monument of the 30,000,000-year-old skull and jaws of a titanotherium, a huge extinct rhinoceros-like mammal, has extended the region over which the animal roamed in North America, according to investigators of the California Institute of Technology. One of the significant features of the find is the clear indication that during the period when this animal, and others associated with it, were present there must have existed in the area basins of vegetation that presented a decided contrast to the barrenness of the region to-day. The climate likewise must have been more favorable to the presence and development of animal life than is the case at present.

SCOTLAND does not welcome one kind of American visitor—muskrats. These natives of the New World, which have become serious pests elsewhere in Europe, have lately appeared in Scotland, and strenuous efforts are being made to exterminate them before they become really numerous. The destruction of approximately 1,000 of the animals has been considered a matter for self-congratulation among Scottish conservationists.

A FERTILE hybrid form of wheat has been obtained by crossing ordinary wheat with spelt, by Professor D. Kostoff, of the Institute of Genetics, Academy of Science of the U. S. S. R. Spelt is a plant related to wheat but belonging to a different species, and all hybrids hitherto made have been sterile. The new hybrid is considered promising from the breeder's viewpoint, since spelt is resistant to a number of plant diseases to which wheat is susceptible. An effort will now be made to transfer these resistant properties by further crossing with hard and soft wheat varieties.



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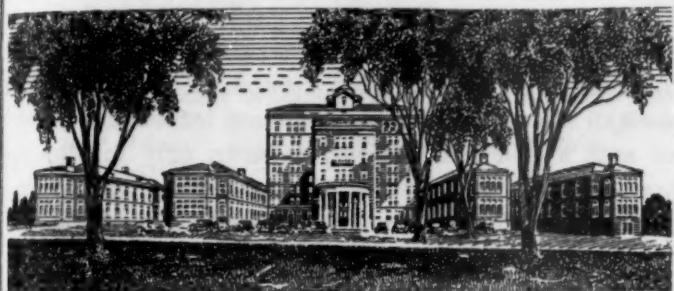
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SCIENCE NEWS

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ALTITUDE MEASUREMENTS FOR THE STRATOSPHERE BALLOON FLIGHT

THE nation's system of topographical surveying will help check the altitude of *The Explorer II*, the giant stratosphere balloon of the National Geographic Society-U. S. Army Air Corps, when it takes the air next month.

In unprecedented degree the altitude of the flight will be accurately checked from a multitude of ground stations along the path of the aerial trip by a corps of volunteer surveyors who will take up stations at the federal "bench marks." These bench marks are bronze markers, spaced thirty miles apart throughout the Plains region which are the key points in the nation's system of topographical survey. The exact positions of the markers are known with great accuracy and from them the surveyors, with transit telescope, will be able to make, every fifteen minutes, measurements on the altitude of the balloon while it is in view.

Equipped with automobiles having radios, special code signals will be broadcast every fifteen minutes, at which time all the surveyors in sight of the balloon will take readings on its stratospheric positions. By trigonometry these readings can be translated into elevation above the surface of the earth. These observed altitudes can be checked with the sealed barographs aboard *The Explorer II* and thus check the accuracy of these instruments at high altitudes.

A third check on altitude at every instant will be the great aerial camera taking photographs of the ground below the balloon at frequent intervals which worked so well on the last flight. The one hitch in this valuable scheme was that the distance between points on the ground (hill tops, valleys, etc.) must be accurately known to calculate the balloon's height from the photographs. This is not always possible, since some of the regions over which the balloon flies have not yet been surveyed with the desired accuracy. Using the three systems in combination, however, a correct height determination is expected.

INFECTION THE CAUSE OF THE COMMON COLD

No matter how much cold and rainy weather a person is exposed to, the individual will not catch a cold unless he is infected by a cold germ caught from another individual, according to Professor Wilson G. Smillie, of the Harvard University School of Public Health. Speaking at the annual meeting of the Associated Harvard Clubs, Professor Smillie described four Harvard expeditions to isolated communities for the purpose of studying the common cold. The investigations were conducted at Stevenson's "Treasure Island," which is St. John's in the Virgin Islands, at a Hudson Bay trading post on the Northwest River in Labrador, at Spitsbergen, the northernmost permanent settlement in the world, and at Happy Hollow on the Patsiliga River in southern Alabama.

Professor Smillie also believes that a person with a

cold is only infectious for three days, even though he may be coughing and have a temperature after that time. Summarizing the conclusions of the expeditions in his address, Professor Smillie said: "Common colds are an infection and are not due to cold weather. Many people think that colds are due to cold weather, but this is not so. In Spitsbergen we found that the people were subjected to intensely cold weather and terrific winds all winter without catching cold; but as soon as the boats came in in the spring and carriers of cold germs arrived, most of the people in Spitsbergen caught colds. On Stevenson's 'Treasure Island' in the tropics, which had a population of 746 when we were there, we found an almost perfect paradise as far as weather and environmental conditions were concerned. The people there also caught colds, but not as long as they were isolated from contact with carriers of cold germs. At the trading post in Labrador we found that the people did not have any colds all winter until a mailman arrived and brought the cold germs in. Then colds spread to the whole community. So we proved that colds are infectious. A person with a cold is infectious, however, only for the first three days. The person may be coughing and have a temperature after three days, but he is not infectious any more."

Explaining the conduct of the investigations in field laboratories, Professor Smillie said that a study of the causes and spread of colds in modern community life would have been unsatisfactory, since our life is so complex, our contacts so frequent and our environmental influences so varied.

"We attempted to simplify our studies by the establishment of field laboratories in these various isolated communities where human contacts are infrequent, life is simple and environmental factors measurable," he said.

Professor Smillie led all Harvard's cold-studying expeditions except the one to Spitsbergen, which was led by Dr. Harland Paul, who has since joined the Rockefeller Foundation. The expeditions have been conducted at intervals since 1927.

PITUITARY GLAND AND THE BLOOD-FORMING ORGANS

THE pituitary gland, already recognized as "dictator" of most of the other glands in the body and largely the controlling factor in growth and reproduction, may have still another rôle. It may control the way new blood replaces old blood in the body.

New experiments just reported indicate that pituitary extract injections produce anemia in animals and two days later new blood cells start to appear to replace the old, depleted ones.

The pituitary gland's new rôle is suggested in a letter from Professor E. C. Dodds, director of the Courtauld Institute of Biochemistry in London, and Dr. R. L. Noble, to the editor of *Nature*. Dr. Noble is working at the Courtauld Institute with the Ellen Mickle Fellowship

SCHOOL AND SOCIETY

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from the University of Toronto. Last year they reported the discovery that stomach ulcers can be produced experimentally by a specially prepared pituitary extract.

Now, they have found that this extract, when given to rabbits, has the additional effect of creating anemia. Marked poverty of the blood appears suddenly four or five days after the injection is given. About two days later there appear cells of a certain type which show that active blood regeneration is taking place. Moreover they consider a series of experiments to have proved that the anemia can not be caused merely by loss of blood from the stomach ulcerations.

There is, therefore, a possibility that what doctors call the "reticulo-endothelial system"—the system concerned with the production of new blood-cells and with the destruction of the old ones—may be to some extent controlled by the pituitary gland.

"So far as we are aware, this is the first time these changes have been produced by an extract of a normal gland," they add, in referring also to changes in the bone-marrow and in the secretion of bile which accompany the great change in the number of red blood-cells.

The action of the pituitary upon the blood-renewing system may not be direct. One explanation might be that the possible hormone which stimulates the flow of acid in the stomach may also stimulate the production of an enzyme that in turn acts upon the blood-renewing bone-marrow.

SELENIUM AS A POISON IN PLANTS

PLANTS are chemically tricked into becoming poisonous to livestock in some parts of the West because a toxic element in the soil, selenium, is chemically a very near relative to the beneficial and necessary element sulphur. So close is their kinship that the absorbing mechanism of the plants can not tell them apart, and so takes in the bad with the good. The remedy for this situation is to add so much sulphur to the seleniferous soils that the indiscriminating plants will get a great deal more of it than they do of the selenium. This, in brief summary, is the plant-physiological picture arrived at by Dr. Annie M. Hurd-Karrer, of the U. S. Department of Agriculture.

The problem of "selenized" plants is one of the most serious which the department has been called upon to solve in recent years. Some time ago, reports began to come in of livestock afflicted with a crippling and finally fatal disease, resulting from eating grain grown in certain parts of the northern Great Plains. The trouble was finally traced to grains grown on soils of one particular geologic type, often low in sulphur but unusually high in the less familiar element selenium.

Laboratory and field-plot experiments at the Department of Agriculture securely fastened the blame on the selenium. Then it was found that the poisonous effects on the plants, and through them on animals, could be almost completely counteracted by adding sulphur compounds to the soil. The amounts of selenium taken up by the plants diminished in proportion to the amounts of sulphur added, and this led to the theory that the two "taste alike" to plants, and are absorbed in accordance with their relative availability in the soil.

When the selenium-poisoning problem first presented itself it caused a good deal of concern, for the afflicted areas were in the midst of a region where commercial grain is produced in some quantity. The practical importance of the problem has been diminished, at least for the present, by the effects of grasshoppers and drought on the agriculture of the region. However, if there is an agricultural come-back in that part of the country, the information that has been obtained should help in meeting problems that may arise.

THE BITE OF THE BLACK WIDOW SPIDER

NOT as black or deadly as she has been painted is the latest medical verdict on the "black widow" spider, according to a statement made by Drs. J. M. Frawley and H. M. Ginsburg, of Fresno, Calif., in a report to the *Journal of the American Medical Association*.

This spider has come to be feared as something of a nation-wide menace since fatalities from its bite have been reported in increasing numbers. Fifty-two cases of black-widow spider bite have been treated without a fatality in the Fresno General Hospital. They believe the right hospital treatment will save life. No treatment or the wrong treatment may result in death.

Here are some details of the treatment they recommend: They put the patient to bed and apply iodine to the site of the bite. He is required to drink large quantities of water and of nonalcoholic fluids. A hypodermic is given to allay the pain and a sedative to permit rest. Then an injection is made of a solution of magnesium sulphate, more commonly known as epsom salts. It is the latter treatment that is credited with relieving the abdominal cramps and the other severe symptoms that follow the spider's bite.

An intoxicated man has a poor chance of recovery once the black widow has injected her poison in him. Nor should any person who has been bitten by this spider be given a drink containing alcohol.

Infants or very small children may not recover because the amount of poison from the bite is large in comparison with their small bodies, and the victims go rapidly into convulsions.

AN INDICATOR FOR EPILEPSY

THE super-sensitiveness which causes hay fever and hives provides a new clue to epilepsy and mental disorders, according to a report by Dr. Joseph A. Beauchemin, of the Middletown, Conn., State Hospital at the meeting of the American Psychiatric Association.

The clue was gleaned from study of the little red bumps called wheals which appear on the skins of sensitive persons shortly after a drop of protein solution has been injected into the skin. The procedure of making these skin tests is familiar to hay fever and asthma patients and sufferers from similar disorders which physicians call allergic. The common feature of all the disorders, ranging from hay fever to migraine headache and hives, is a super-sensitiveness to protein from various sources: plant pollen; foods like milk, eggs, shell fish; feathers; or dust.

Proteins from meats and cereals and fats produced the

little red bumps on the skin of eight tenths of the epileptic patients he studied, Dr. Beauchemin reported. From this he concluded that a disturbance in the handling of these foods by the body tissues is an important feature in epilepsy.

The red bumps were caused in sufferers from mental disorders not by food or plant proteins but by solutions of gland substances. Patients suffering from dementia precox were super-sensitive to thymus and sex gland extracts, indicating a disturbance in these glands which may be only a concurrent symptom or may be of more significance.

Patients in the excited phase of maniac-depressive disorder were as a group super-sensitive to adrenal, thyroid and pituitary substances. A possible over-activity of the pituitary and adrenal glands which in turn stimulates the thyroid and sex glands is Dr. Beauchemin's interpretation of the results of skin tests with this group. Patients in the depressed phase of the same mental disorder reacted to the gland substances in a way suggesting over-activity of the pituitary and of the cortex of the adrenal glands. More of these patients than of those in any of the other groups showed super-sensitiveness to proteins from bacteria, indicating that they might be more susceptible to infectious diseases.

GLANDS AND EMOTIONS SEEN AS FACTORS IN EPILEPSY

A GLANDULAR basis for fits or convulsions, such as those occurring in epilepsy and possibility of treating the disease by gland extracts in the future, were suggested at the meeting of the American Psychiatric Association. Emotional upsets were also blamed for causing epileptic attacks and good results from psychiatric treatment in such cases and from dietetic treatment of other cases were reported.

The rôle the glands, particularly the pituitary gland, may play in epilepsy was discussed by Dr. Albert W. Pigott, of the New Jersey State Village for Epileptics. Dr. Pigott reported two cases of diabetes occurring in epileptics, a rare occurrence. In records of over eighteen thousand epileptics, Dr. Pigott found only thirteen cases of diabetes.

The two conditions are in a way contradictory and Dr. Pigott pointed out that the fundamental mechanisms in the two diseases are antagonistic. Epilepsy, it seems, may be thought of as anti-diabetes. Diabetes is characterized by too much sugar in the blood and diminution of water in the body. In epilepsy there is an accumulation of fluid in the body. During convulsions, furthermore, epileptic patients have less sugar in their blood than in the period between convulsions. This fits in with the fact that convulsions are a feature of insulin shock, which occurs when a diabetic patient gets more insulin than his body requires to burn the amount of sugar and starch that has been eaten.

The pituitary gland is now known to produce a hormone that can bring on the diabetic state of too much sugar in the blood and it also plays an important part in regulating the body's use of water. Dr. Pigott suggested that a decrease in the diabetes-producing hormone of the

pituitary may play a rôle in some cases of convulsions due to deficiency of sugar in the blood. He recalled that Dr. Harvey Cushing, of Yale University, was able to prevent convulsions in some epileptics by giving them pituitary gland substances. In one of the cases of diabetes complicating epilepsy described by Dr. Pigott, the average number of convulsions was reduced from twelve or thirteen a month to four or five after diabetes had developed.

ITEMS

DISPLAYING a clock made by royal hands of young Pharaoh Tutankhamon, in the land of Egypt over 1,300 years before Christ, Professor James H. Breasted, of the Oriental Institute of the University of Chicago, described how courageous Egypt pioneered in conquest of "time and its mysteries." He gave the annual James Arthur lecture on "Time" at New York University, where the Arthur collection of clocks and watches is maintained. Tutankhamon's transit instrument for determining the hour by the stars was reposing in an antiquity shop in London. An inscription on the instrument states that Tutankhamon made it with his own hands. Professor Breasted emphasized that the instrument was not unearthed in Tutankhamon's tomb, but was made by him in restoring tomb equipment of one of his royal successors. The shop that had it thought it part of an Egyptian writing kit, and Professor Breasted was first to recognize its true significance. This timepiece and another belonging to Tutankhamon's grand-father-in-law are the oldest surviving astronomical instruments.

THE popular custom of offering guests peppermint candy or peppermint cordials after a heavy meal has scientific support in the findings of four Chicago physicians, Drs. H. I. Sapoznik, R. A. Arens, Jacob Meyer and Heinrich Necheles, who report on their investigation in the *Journal of the American Medical Association*. Tests made both on dogs and on human beings showed that the oil of peppermint that is present in peppermint candy has a decided motor action on the stomach. Digestion is speeded up, and the stomach empties an hour faster. The peppermint is particularly useful after a meal with a high fat content, making the person's stomach feel less full and distended.

COLOR, rather than sweetness of corn, was prized by American Indians in olden times, according to the opinion of Dr. A. T. Erwin, of the Iowa Agricultural Experiment Station. Among all collections of prehistoric corn in museums, Dr. Erwin finds only one undoubted example of true sweet corn. But the ancient color scheme of corn is varied, including blue, red and yellow grains. Modern natives of Mexico, land thought to be the "cradle" of corn, raise many types of corn, but not one specimen of sweet corn was detected by Dr. Erwin in an investigation there. Sweet corn is thought to have been cultivated in the United States in the first half of the nineteenth century. It is apparently an offshoot of field corn, whose accidentally sweet grains the Indians did not trouble to propagate. Only the white man noticed the delicate difference.

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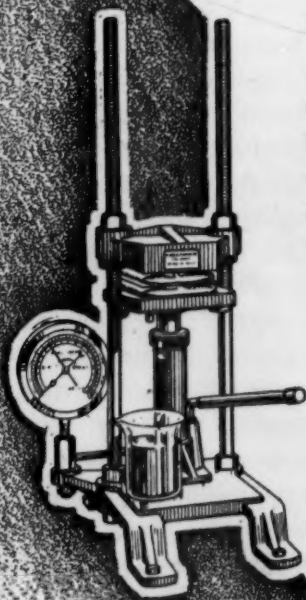
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SCIENCE NEWS

Science Service, Washington, D. C.

RADIOACTIVITY AND THE FORMATION OF PLEOCHROIC HALOES

In a chip chiseled from the front doorstep of his college, in the sands of Nova Scotia's famed bathing beaches and in specimens of biotite mica from the Orient, Dr. George H. Henderson, of King's College, Dalhousie University, Halifax, has found evidence of what may prove to be unknown chemical elements no longer existent on the earth's surface.

In an interview at the meeting of the Royal Society of Canada, meeting at Hamilton, Ontario, Dr. Henderson said he had recently discovered at least three new types of pleochroic haloes which have so far been inexplicable as due to already known elements. The time required for their formation, possibly only a few hours or days, although perhaps as great as one hundred years, is much too short to be compatible with geological evidence.

"A pleochroic halo, one of the most striking manifestations of radioactivity," Dr. Henderson said, "might be compared to a photographic negative. It is caused by alpha rays emitted by members of the uranium family of elements as each disintegrates to form the next in the atomic scale. The rays emitted during this disintegration of the uranium crystal act upon mica and certain other minerals in a similar manner to that in which light affects the silver salts of a photographic film."

A dark spot is produced in the mica around the uranium particle. This is surrounded by a series of six concentric dark rings, whose diameter is measured with a halo photometer designed by Dr. Henderson, which allows more accurate determinations than are possible with a microscope.

"The sizes of these halo rings made millions of years ago corresponded exactly with recent laboratory observations on radioactive elements," Dr. Henderson said. "This proves conclusively that the laws of physics as we know them to-day held good even at the time of formation of the earth's crust. The largest outer ring is no greater in size than a human hair in diameter."

As these haloes disappear at temperatures around 900 degrees Fahrenheit, Dr. Henderson infers that the Precambrian rocks from which much of the mica was obtained can not have reached that degree of heat since they were formed.

CONTINENTAL DRIFT

New measurements fail to indicate that the continents of the earth are drifting apart as the much-discussed theory of Professor Alfred Wegener suggested many years ago. The theory pictured North and South America as originally linked with Europe and Africa with the various peninsulas and gulfs and bays fitting like a jigsaw puzzle. Then, over the long periods of geological time, the continents drifted to their present situations.

C. C. Smith, of the staff of Dominion Observatory, Ottawa, reported to the meeting of the Royal Society of Canada the observations which fail to check the Wegener hypothesis of continental drift.

In 1926 the International Astronomical Union began to check up on the theory. Accurate longitude determinations of key cities in North America and in Europe were then made. Periodically their positions have been redetermined. Star observations, clocks and wireless time signals made these determinations possible.

The distance between Ottawa and Vancouver, Canada, apparently has shrunk some nineteen feet in the last nine years, while between San Diego and Washington the American continent has apparently expanded nearly 40 feet. The differences are, however, just at the borderline of the accuracy of the observations. Mr. Smith reported that the American continent shows on the average an easterly drift toward Europe which is the opposite of the Wegener predictions and that these anomalies "are to be expected from the proportion of the quantity measured to the probable error and probably several decades will have to elapse before the Wegener theory can be finally tested by longitude measurements of this character."

THE AMPLIFICATION OF HEART SOUNDS

AN electrical stethoscope which enables a hundred doctors and medical students to listen to heart and lung sounds was described before the Royal Society of Canada by Dr. K. A. Evelyn, of the university clinic, Royal Victoria Hospital, Montreal.

With a powerful microphone and loudspeaker amplifying system attached to the ordinary stethoscope, physicians—and physicians-to-be—can quickly learn the characteristic sounds for various heart ailments. Moreover, a system, like the tone control on a radio set, enables the doctors to separate the various sounds of the heart beat into the low- and high-pitch components. This is a new aid for diagnosis.

The secret of success of the new stethoscope is the sound-proof box in which the microphone is placed. This cuts out all extraneous noises which might mask, when amplified, the delicate sounds of the heart beat. Once the heart beat is turned into electrical impulses it is easily possible to pass them through a cathode ray oscillograph and obtain a continuous picture which can either be obtained visually or photographed on a motion picture film for permanent record.

The idea of using amplifying systems to allow many people to study heart beats is not, in itself, new. Drs. C. J. Gamble and D. R. Replogle, of Philadelphia, reported a similar device to the American Medical Association in 1924. But with the advance of radio and electrical science in the last eleven years techniques formerly not available are now possible. Especially is this true for the tone control, or frequency sorter, which Mr. Evelyn's device employs.

PROGRESS IN THE STUDY OF CANCER

FEVER treatment combined with small repeated x-ray doses gave better results in treatment of a certain type of cancer in rabbits than either method alone, Dr. Staf-

ford L. Warren, with John J. Jares and Otto Sahler, of Strong Memorial Hospital, Rochester, N. Y., has found in preliminary tests of this method of attack on cancer. This study was announced in the report of the International Cancer Research Foundation of Philadelphia which is supporting Dr. Warren's research. Application of this work to human cancers is far in the future, if it proves possible. So far only one type of cancer has been investigated and only small numbers of animals have been used.

Three years ago, working with funds from the Rockefeller Foundation, Dr. Warren found that high fever temperatures would kill cancer cells outside the body within a definite period of time. He found that high temperature also destroys cancer cells in the body, but only in one fifth of the cases. Small repeated doses of x-rays, called fractional doses, destroyed the cancers in nearly half (42 per cent.) of the cases. When the fever treatment was combined with the fractional doses of x-rays, the percentage of apparent cures was doubled (84 per cent. of the cases).

Other researches include the following: For the first time human cancers can be kept alive and growing for long periods of time outside the body. Dr. George O. Gey, of the Johns Hopkins Medical School, reported his new method which should aid greatly efforts to find better ways of destroying cancers. The mystery of why cells become malignant may be nearer solution.

Another cancer-producing substance has been prepared from coal tar by Professor J. W. Cook and associates at the London Free Cancer Hospital. Professor Cook's latest discovery shows the importance of a certain kind of chemical architecture in cancer-producing substances from coal tar. A combination of carbon and hydrogen known to chemists as the methyl group—the same methyl group that is in deadly methyl alcohol or wood alcohol—occurs twice in the new cancer-producing compound. Apparently more important than the methyl group itself, in connection with the cancer-causing property of the new substance, is the place where it is attached to the substructure of the new substance as its molecule is built up. Even a single methyl group at "position 5" causes marked cancer-producing activity.

Calories also have an important relation to cancer. Studies on this phase of the problem have been made by Dr. Fritz Bischoff and coworkers of the Santa Barbara, Calif., Cottage Hospital. Growth of cancers in mice is notably affected by reducing by half the amount of calories in the diet of the mice. Weight loss in itself is not a clear indication of the nutritional state, as other factors enter in. Consequently, emphasis is laid on the importance of determining caloric intake.

ETHYLENE GAS IN HORTICULTURE

ETHYLENE gas, widely used to blanch celery, bring the glow of ripe color to the skins of fruit, and otherwise hasten the maturing of garden products, is actually generated by plants in the natural process of maturing for the market. Such are the indications of researches conducted at the Minnesota Agricultural Experiment Station by R. C. Nelson and R. B. Harvey, and independently

at the Low Temperature Research Station at the University of Cambridge.

In their experiments, Nelson and Harvey used young tomato plants as "indicators" for the gas. The response of a tomato plant to ethylene is characteristic. It arches its leaves downward. These "indicator" tomato plants were put into closed glass vessels. Into similar vessels quantities of a self-blanching variety of celery were introduced. After two hours, the gases from the celery vessels were drawn into the glass prisons of the tomato plants. The leaf-stems of the latter curved downward strongly, showing that a compound with the physiological effects of ethylene was produced by the celery. In a parallel test, using a non-blanching celery variety, the tomato plants did not respond: no ethylene was being produced. Similar results were obtained in the Cambridge University experiments, in which the ethylene gas was produced by ripening apples.

Nelson and Harvey call attention to a practical significance of this discovery. When ethylene, best known as a constituent of illuminating gas, first began to be widely used for the treatment of fruits and vegetables, the question was raised whether it might not possibly have harmful effects. Now, they state, "Since it has been shown to be produced by blanching celery under natural conditions, any fear of artificially using this gas should be removed from the minds of the public."

THE FUTURE FLYING MACHINE

LARGE tailless airplanes propelled by engines within the wings and fueled by economical heavy oil are visualized as the result of research achievements of engineers of the laboratories of the National Advisory Committee for Aeronautics.

Tails on airplanes are likely to disappear because Uncle Sam's experts have found that wasteful air resistance created at the joining of wing with fuselage can be eliminated by using tapered wings and devices to replace the tail.

Cooling air blown over engines housed within the wings promise to make possible speedier and more economical flying. And engines that ignite heavy oil fuel by compression instead of gasoline by sparks from plugs promise to give more air miles on less fuel, increasing the pay load in passengers and freight carried.

Aeronautical experts receive these latest reports with confidence because fresh in their experience are marked increases in speed of airplanes without added cost achieved through NACA researches. The famous cowling for aircooled engines and new locations for engines in relation to wings actually increased multi-engined airplane speeds from a normal 125 miles per hour to 200 miles per hour without a single horsepower increase in engine power. The reward was faster air transport schedules and much saving in time and money.

Other new NACA results of the past year include: A simple fixed landing gear that is as efficient as present landing apparatus that must be retracted during flight. New researches on the vertical ascent of autogyros, which is accomplished by storing energy in the rotor wings and then using it for the ascent by

suddenly increasing the rotor pitch. Flaps on airplane wings that reduce the landing distance to about half and the take-off distance by about a quarter.

PATENTED PLANTS

PATENTED flowers, fruits and other plants have not accumulated very fast since the plant patent law went into effect five years ago, on May 23, 1930. Files of the U. S. Patent Office show only 124 plant patents of all kinds, contrasted with the thousands of patents on mechanical devices and processes that pour from inventor's brains every year.

Four classes have thus far proved sufficient for the arrangement of plant patent records: roses, other flowers, fruits and "plants"—the latter category being a catch-all for everything that is not classifiable as either flower or fruit.

Aside from roses, patented flowers have run rather strongly to carnations, dahlias, chrysanthemums and freesias. Among patented fruits, apples, plums, cherries, grapes and avocados are conspicuous. Patented vegetables are conspicuous by their absence, but there is one patented mushroom.

The highest number of plant patents granted to a single applicant is nine, to the estate of the late Luther Burbank. The Burbank patents include two roses, five plums, one peach and one cherry. There are at present, however, several commercial nursery companies that hold numerous plant patents, sold or assigned to them by the inventors. A number of patents have been granted to breeders in England, Holland, Czechoslovakia and other foreign countries; most of these have been assigned to American firms.

To be patentable, a plant must be capable of "asexual" propagation, that is, it must be reproduced from cuttings, bulbs, grafts or by any means other than seed. From the provisions of the law, however, tuber-propagated plants like potatoes are excluded.

When an application for a plant patent is received it is not only examined by officers of the U. S. Patent Office, but is submitted also to the Bureau of Plant Industry of the U. S. Department of Agriculture, which has a corps of botanists and horticulturists capable of judging whether the variety is really new and distinct, and also of certifying whether or not its method of propagation makes it eligible to patent rights under the law.

ITEMS

How man is exceeding nature in the artificial production of piercing gamma rays like those given off by radium and used in cancer treatment, is pointed out in the latest report from the California Institute of Technology. Nearly two and a half times more piercing than the natural gamma rays is the radiation liberated from the light element beryllium when it is bombarded with protons, the nuclei of hydrogen atoms, according to the report of Professor C. C. Lauritsen and Drs. H. R. Crane, L. A. Delsasso and W. A. Fowler to *The Physical Review*. Champion of natural gamma rays for piercing power are those from thorium C" having energies equivalent to 2,600,000 electron volts. Professor Lauritsen's

beryllium rays have energies equal to 6,000,000 electron volts. Record energies for artificially man-made gamma rays are those which Professor Lauritsen obtained by bombardinug lithium with protons. These gamma rays had energies equal to 16,000,000 electron volts.

A LOUD high-pitched sound produces more ear strain and a greater loss of hearing if it is interrupted every second instead of being continuous, Dr. Elmer Culler and Glen Finch reported to the Midwestern Psychological Association meeting at Lawrence, Kans. Thus the well-known engineering rule that oscillating stresses are more destructive than a dead load of the same magnitude is found to hold for the cochlea of the ear just as it does for a bridge. Long exposure to a note of 1,000 cycles frequency, which is near the upper limit reached by the soprano voice, will be followed by a loss of hearing for notes of all frequencies down even lower than middle C at 256 vibrations a second. When a sound at the upper limit of the musical scale, 4,000 cycles in frequency, was continued over ten hours, the loss of hearing increased from a 55 decibel loss for sounds at 125 cycles to 104 decibels at 4,000 cycles. A noise of 55 decibels corresponds to the sounds of an average city street, while a 104 decibel sound is equivalent to the noise in a boiler shop.

MAPPING all the variations of natural radioactivity over the earth is a project put forward by Dr. V. I. Vernadsky, of the U. S. S. R. Academy of Sciences. Intensity of radioactive activity in each locality would be indicated on the map as a vertical projection, making possible the tracing of "isoradioactive" lines. Such a map would have a two-fold importance. For the benefit of "pure" science, it would help to bring out more clearly the distribution of crustal rocks in order of their geologic age, for the ages of rocks are indicated in part by their degree of radioactivity. On the applied science side, it might help locate new helium wells, since helium is everywhere a natural product of radioactive decomposition of the rocks, though in only one or two places known at present have conditions been such as to bring about its accumulation in economically paying quantities.

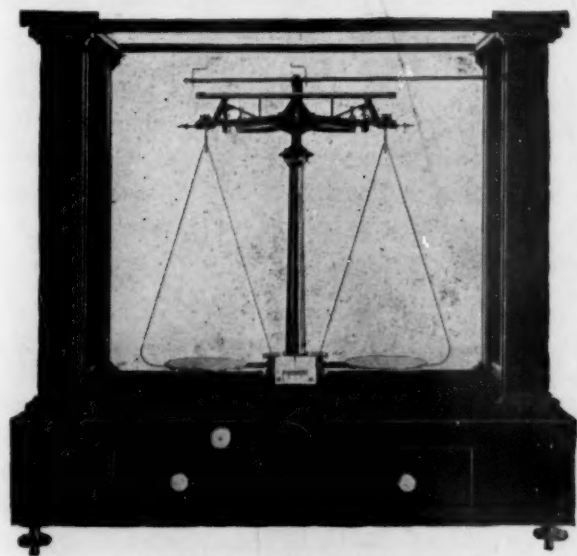
BRAZILIAN cotton has been severely damaged by the season of heavy untimely rains, according to information received by the Bureau of Agricultural Economics of the U. S. Department of Agriculture. Brazil's chief cotton lands, where the great cotton boom of the past two years has been going on, lie some hundreds of miles to the southwest of stricken Bahai, principally in the state of São Paulo, but the rains have been going on steadily there during what is normally the dry cotton-picking season. The damage has been two-fold: first, direct deterioration in the quality and size of the crop; second, continued growth of both cotton plants and weeds. The lack of cool weather in the Brazilian autumn (which coincides with our spring) is a standing source of difficulty in the Brazilian cotton-growing area, since the unchecked growth of the plants furnishes ideal conditions for the attacks of bollworm and other insect pests.

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THE EQUIVALENCE OF MASS AND ENERGY

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NEW proofs of Einstein's law that mass and energy are the same thing in different forms has been evolved by Professor H. A. Bethe, of the Cornell University department of physics.

The Cornell work removes an obstacle from one of the most important advances now under way in science, the investigation of the atomic nucleus. In the disintegration of the lightest elements, such as deuterium and lithium, the loss of mass was offset by an equivalent amount of energy, thus confirming Einstein's law.

Apparent contradiction to this law had arisen when investigators disintegrated heavier nuclei, such as beryllium and boron. Not enough energy seemed to be given off when these elements were disintegrated. This cast doubt on the validity of the Einstein formula.

Starting from the point that most nuclei disintegrate into helium, Dr. Bethe suggested that the mass of the helium nucleus was greater than previous measurements had indicated.

He was able to compute the atomic weights of all light elements to a greater accuracy than any previous method in chemistry or physics had given. With these more accurate masses Einstein's law was found to hold for every nuclear disintegration thus far investigated.

By a coincidence an independent investigation, conducted by Dr. F. W. Aston, confirmed by direct measurement the most important of the new atomic weights which Dr. Bethe had arrived at by the theoretical method. With confidence again restored in the validity of Einstein's law of the equivalence of mass and energy, the path is now open for probing the remaining secrets of the structure of matter which are bound up in the invisible nucleus of the atom.

OBSERVATION OF THE STRATOSPHERE
BALLOON

AN eye more used to watching the remoter heavens will be training an eight-inch telescope on the stratosphere balloon, *Explorer II*, if it drifts within 50 miles or less of Des Moines.

Dr. D. W. Morehouse, astronomer, president of Drake University and director of the Des Moines Municipal Observatory, is preparing to take accurate position observations on the big bag, if it floats within sight, just as though it were a comet or other stranger in outer space. In good "seeing weather," his instrument can pick up an object of that size at a range up to 50 miles, if it floats as high as stratosphere balloons are wont to do, says Dr. Morehouse.

Last summer, Dr. Morehouse kept lone and vain vigil, while the stratosphere balloon met mishap over Nebraska. This year, an elaborate set-up of topographic engineers all over the Midwest, kept posted by radio, will take simultaneous "shots" at the balloon as it drifts within range of their instruments. Dr. Morehouse is tying his

much larger telescope into this network of scientific spy glass men.

Dr. Morehouse first attracted wide popular notice about 25 years ago, when he discovered the brilliantly spectacular naked-eye comet that bears his name. That was at the time of the last visit of Halley's comet; and the two objects, Halley's comet in the early morning hours and the Morehouse comet just after sunset, for months furnished beautiful and awe-inspiring celestial fireworks.

THE EFFECT OF SUNLIGHT ON
SEEDLINGS

STRONG sunlight shining on leaves of tree seedlings causes their roots to burrow deep into the soil. Leaves of seedlings in full sun lose from 20 to 250 per cent more water than do similar seedlings grown in partial shade. Half-shade favors growth of some seedlings, while other species do better on all the light they can get.

These results, which have bearing on young tree cultivation in prairie regions, are among those obtained by Harold H. Biswell, of the University of Nebraska, in experiments on a number of tree species planted in three different soil types near Fayette, Mo. Mr. Biswell's report will be made in detail in the June number of *The Botanical Gazette*.

Mr. Biswell found that seedlings generally have much more of their total length below ground than above it. Honey locust seedlings had roots one and a half times as deep as their tops were high; hickory seedling roots drilled to ten times top height; other species were intermediate.

Tree-root systems were found to be highly plastic, organizing themselves according to the nature of the soil, and especially according to the depth at which they strike permanent water. Thus, cottonwoods are very shallow-rooted on the flat floodplains of streams, but on dry uplands they send down taproots to very considerable depths.

THE IMMUNITY OF SKUNKS TO BEE STINGS

SOME observations on the ill habit of striped skunks in raiding bee colonies are recorded in the new issue of *The Journal of Mammalogy*. The studies were made by Dr. Tracy I. Storer, of the University of California, and Dr. Geo. H. Vansell, of the U. S. Department of Agriculture, both working at the Pacific Coast Bee Culture Laboratory.

Drs. Storer and Vansell found evidences of dirty work at midnight around some of their beehives. Animals, which proved to be skunks, were coming round, scratching at the outside of the hives to make the bees swarm out to defend their homes, and then beating them down with their paws and eating them. They soon learned which hives held the bees most resentful of intruders, and concentrated their attentions on them, to such an extent that they weakened the colonies almost to extinction. Examination of the stomach contents of trapped animals showed that they were living almost entirely on bees.

Stings seemed to hold no terrors for the marauding skunks. Animals captured had them abundantly in mouth and throat membranes; one skunk yielded no less than sixty-five such stings. It is thought probable that the bees inflicted the stings after they were dead, by reflex muscular action.

Precautions were observed in trapping: "The skunks which we captured were taken in an unbaited, exposed steel trap. . . . The trap chain was fastened to the end of a 12-foot scantling. Each skunk, as captured, was led gently (the operator being on the other end of the scantling) to a near-by garbage can filled with water and drowned without any unpleasant consequences."

Drs. Storer and Vansell believe that drought had something to do with driving the skunks to more-than-ordinary beehive raiding. The season had been very dry, the ground hard, and insects which skunks normally dig up for themselves consequently hard to get. Hence their transfer to a "hotter" diet.

MALNUTRITION AND CATARACTS

LACK of proper food for families hit by the depression may "take a horrible toll" in increased numbers of sightless children, Dr. Emanuel M. Josephson, eye specialist of New York, told a recent meeting of the Eugenics Research Association.

The public should be warned that unbalanced depression diets, lacking in the proper vitamins, may result in eye disease and blindness. Inexpensive foods added to the depression diet may prevent the development of this "hunger blindness." Carrots and other vegetables, and cod-liver oil are among the foods which protect against it.

A family in which almost half the descendants of one grandmother suffered from cataracts, a condition of the eye which gradually veils the sight, was reported by Dr. Josephson as an instance of how the tendency to eye disease may be inherited but brought on by living conditions. Although so many members of this particular family developed cataracts, some of them beginning before the birth of the child, another branch of the family in better financial condition did not have a single case of this disease down to the third and fourth generations.

Dr. Josephson pointed out that cataracts are not the only eye disease which may result from environmental conditions such as malnutrition. Day blindness, a disease common in the poorer countries of the Orient, which causes the patient to see less by daylight than at night, has become wide-spread in the United States for the first time during the depression. This disease, and its later stages, nightblindness and keratomalacia or softening of the cornea, and xerophthalmia (dry eyeball), are due to lack of vitamin A in the diet.

Dr. Josephson concludes that "if America wishes to take no risk of becoming, like China, a country with a high incidence of blindness and eye disease due to prolonged malnutrition, prompt action must be taken."

THE EVOLUTIONARY BASIS FOR ABNORMAL BONE GROWTH IN THE EAR OF MAN

MANKIND may be paying for the rapid evolution of his head, during the past half-million years, with serious

ear troubles. This conjectural explanation for the abnormal bony growths in the auditory canal, known as ear exostoses, is offered by Dr. Aleš Hrdlička, physical anthropologist of the U. S. National Museum.

These distressing growths are not the result of disease, but are simply runaway phenomena of ordinary growth. They often impair hearing, and sometimes cause death. They are exceptionally numerous in the skulls of American Indians and South Sea Islanders represented in the Smithsonian Institution collections, but no race can be considered immune. Concluding his explanation, Dr. Hrdlička said:

"Only one thought may here be permissible, but that must not be taken for an assertion. Within some 500,000 years man's progress, especially as concerns his brain and head, has far outstripped that of all the rest of creation. This rapid progress and differentiation, with a spread to all regions and exposure to a multitude of new factors, has prevented in many respects a full adjustment of all parts, a full harmonization and stability in all regions.

"There is a possibility that the central trophic control of the external meatal region in the greatly enlarged, altered and still altering skull, has not regained the full lifelong adequacy that it possessed before. This would mark the abnormality as an incidental condition that might disappear in the natural course of events if further skull changes affecting the part stopped and if direct inheritance of the abnormality did not meanwhile become rooted."

PATAGONIA YIELDS HITHERTO UNKNOWN FOSSILS

BONES of an extinct flesh-eating animal related to the kangaroo but much bigger than a grizzly bear, fossil frogs, remains of a totally new kind of fossil browsing animal five feet high, are among the scientific trophies brought back from South America to the American Museum of Natural History by Dr. George Gaylord Simpson, associate curator of vertebrate paleontology.

Dr. Simpson and his associates made actual a semi-legendary "place of bones" deep in the interior of Argentina's "Wild South," Patagonia, as the result of a chance sight of a fossil jawbone in a bank in Buenos Aires. They went through adventures of an almost Marco Polo type, including a brief sojourn at the ranch of a veritable ogre of a bushy-eyebrowed killer known as the Terrible Turk, and passage through a land where the natives valued money at nothing, but would sell you anything you wanted for an empty tin can.

Finally, after disappointing searchings in the region to which they had been directed, they found, in a fissure-sided hill, a tremendous deposit of bones, believed to be one of the richest "fossil mines" ever discovered. The deposit appears to be the silted-up bottom of an ancient lake that formed in the crater of an extinct volcano. Apparently animals coming down to drink were overcome and killed by poisonous fumes from cracks in the earth, which were the dying gasps of the old volcano itself. The bones were so thick, where they had been weathered out in the course of ages, that they cluttered the ground, and the explorers stumbled over them. The big, hitherto unknown herbivorous animal they found has been named

Scarritia, in compliment to H. S. Scarritt, sponsor of the expedition.

ITEMS

NORTHERN INDIA, stricken by disastrous earthquake on May 31, is one of the "most seismic regions in the world," Frank Neumann, seismologist of the U. S. Coast and Geodetic Survey, told Science Service. In prehistoric, possibly pre-human, times the most tremendous earthquakes the world has ever known rocked the region, as is evidenced by geological structures still existing. The mountains are still growing, so that earthquakes are still to be expected fairly frequently. A violent earthquake there on August 26, 1931, killed several hundred people. There was another sharp shock, though not fatal in its effects, on June 14, 1934. The location of the epicenter of this earthquake was an unusually difficult matter, because of its remoteness from the reporting seismograph stations. However, the Jesuit Seismological Association, St. Louis, Mo., has calculated a tentative location in latitude 27.3 degrees north, longitude 65.7 degrees west. This is in the mountainous region of eastern Baluchistan, approximately 220 miles in a southeasterly direction from the ruined city of Quetta.

PROFESSOR G. H. PARKER, Harvard University zoologist, held a watch on three different hippopotamuses, in the zoological gardens at Hamburg, Germany, Philadelphia and Washington, respectively, as the huge creatures, immersed in their tanks, came bubbling up at intervals to breathe. He found that the longest time that any of them stayed under was 4 minutes 40 seconds, the shortest time 5 seconds, and the average time 2 minutes 14 seconds. This, he comments, does not come anywhere

near the long breath-holding performances of submerged whales, which are truly aquatic mammals. The hippo is to be classified as an amphibious rather than an aquatic animal. Professor Parker's observations are recorded in detail in the current issue of *The Journal of Mammalogy*.

THE heavy mortality among infants under one year of age is due in large part to inferior quality of the eggs from which these infants started life, Dr. George L. Streeter, of the Carnegie Institution of Washington, stated in a lecture delivered under the auspices of the Harvey Society. Experiments with frogs' eggs and pigs' eggs were cited by Dr. Streeter to show how poor quality prevents survival. A baby starting from a poor egg is badly handicapped in the struggle for survival, he pointed out. Many of them can not withstand the hardships of the first year of life and particularly the change in living conditions met at birth. These infant deaths, he said, represent Nature's first sorting of the fit from the unfit.

MAN-EATING sharks have been claiming increasing numbers of victims, recently, along the Australian coast, especially on the beaches of New South Wales, according to Gilbert Whitley in a report to *The Victorian Naturalist*. The number of authentic shark-attack records in the decade 1912-21 was 13; in the decade 1922-31 it jumped to 45, and in the three-year period 1932-34 there were sixteen recorded cases of shark onslaughts. It is believed that the increasing use of bathing beaches is responsible for the rising count of tragedies. Enclosing beaches in netting or "shark fences" is strongly advised, with patrolling from airplanes or "shark towers" where such complete protection is not practicable.

Analytical Determinations with EASTMAN ORGANIC CHEMICALS

POTASSIUM with No. 420 Tartaric Acid—

Bolliger, AUST. J. EXPTL. BIOL. MED. SCI. 12, 75.

VITAMIN C with No. 573 Methylene Blue—

Martini and Bonsignore, BOLL. SOC. ITAL. BIOL. SPER. 9, 338.

HEMOGLOBIN with No. 33 Benzidine—

Letonoff, J. LAB. AND CLIN. MED. 20, 66.

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THE ATLANTIC CITY MEDICAL MEETINGS

"MAN's place in future history will depend in no small degree on the food he eats." This prophecy was made by Dr. James S. McLester, of Birmingham, Ala., of the American Medical Association, in his presidential address before the joint sessions of that organization and the Canadian Medical Association. Longer life, larger stature, greater vigor and a higher level of cultural attainment are promised to those races of man that take advantage of the new knowledge of nutrition, Dr. McLester said. Man is no longer a puppet of fate, but through scientific advances in the study of foods and health he can now, to a considerable degree, be master of his own destiny. Scientific men have pointed the way for man to attain this mastery. The problem now rests with those responsible for education and government. People must be taught what foods to eat and they must be insured an adequate supply of food. Something like twenty million American people are probably getting barely enough, or in some cases not even enough, food of the kind to keep them healthy. "This condition, if continued, will surely affect the health of the race. To make agriculture profitable to the extent that a good rural population can be maintained and at the same time the rest of the population supplied with cheap food is a problem that confronts the nation." While he did not himself offer a solution of the problem, he quoted the report of the Elgin Committee, appointed to determine a national agricultural policy for Scotland, as follows: "It is in the interest of the state that the price of food be kept so low that the poorest can obtain an adequate dietary."

"THE breath of life is oxygen; the seat of life is the cell," said Dr. Jonathan C. Meakins, of Montreal, president of the Canadian Medical Association, in his address before the joint sessions of his organization and the American Medical Association. Dr. Meakins described the "beautifully subtle manner" in which animals, including man, acquire "this essence of life imperative for survival" and the way in which they incidentally use it for "that love song, so to speak, with which to allure a mate for the perpetuation of the species." Oxidation—the combining of oxygen with foodstuffs—always follows the liberation of energy in the animal body, but just how living material such as animal tissues are able to convert the chemical energy of foodstuffs into mechanical energy is not known. "Our modern conception of calories, combustion and the fine values of foodstuffs has brought the idea of oxidation so much before our minds that we are apt to consider our bodies as a sort of glorified steam engine puffing laboriously through life on the caloric equivalents of breakfasts, lunches and dinners." This conception, however, is a fallacy, Dr. Meakins pointed out. If the liberation of energy in our bodies took place by the conversion of foodstuffs to heat with a working efficiency of 25 per cent., the temperature of the heat source

would have to be far above the temperature at which life can continue.

THE mystery of agranulocytosis, new and fatal disease of too few white cells in the blood, seems nearer solution as a result of studies reported by Drs. Francis P. Parker and Roy R. Kracke, of Emory University, Georgia, at the meeting of the American Society of Clinical Pathologists. The disease is apparently caused by certain popular headache remedies and pain-relieving drugs which contain a chemical group known as the benzene ring. That discovery, however, did not entirely solve the mystery of the disease because so many persons use these drugs in large quantities while comparatively few develop the disease. Benzene's effect of reducing the number of white blood cells may take place by reducing the amount of a sulfur-containing substance found in blood and bone marrow. This substance is glutathione and it is thought to be responsible for speeding up cell division in the bone marrow where blood cells are formed. Examination of the bone marrow in cases of granulopenia showed that the rate of cell division was slowed up. Consequently Drs. Parker and Kracke believed that the relation between the benzene and the glutathione is at the basis of the disease. It is not yet possible to say whether the benzene reduces the glutathione and thus slows up cell division and consequent production of new white blood cells, or whether it works the other way around so that persons with less glutathione develop the disease when they use benzene-containing drugs.

INFECTION is probably the result, not the cause of the fatal, cancer-like blood disease called leukemia. Evidence supporting this new view of the cause of the disease was presented by Drs. Jacob Furth, Henry W. Ferris and Paul Reznikoff, of New York City. Leukemia is characterized by an excessive number of immature white cells in the blood. In leukemia, as in cancer, the cells that multiply with such disastrous effect are malignant cells with characteristics of their own that form a new and abnormal growth. The disease further resembles cancer in that it can arise from a variety of causes, the form it takes depending on various factors. Instead of being brought on by infection, as formerly believed, the leukemia occurs first. The consequent derangement of normal cell formation breaks down resistance to infection, in the opinion of Dr. Furth and associates. Close questioning of human patients disclosed that the disease had probably been in progress long before the infection which led to discovery of the leukemia. Studies of the disease in mice, which is a close parallel to the human form, gave further evidence that the infection followed the disease and did not cause it.

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chance of being promptly cured by a few sessions of fever treatment, according to Dr. Philip S. Hench, of the Mayo Clinic, who spoke before the American Association for the Study and Control of Rheumatic Diseases. Fever treatment does not, however, offer nearly so much hope to patients suffering from other forms of arthritis, Dr. Hench emphasized. Dr. Hench showed pictures of some patients afflicted with gonorrheal arthritis or rheumatism hobbling around painfully on crutches one day and walking briskly about twenty-four to forty-eight hours later. Early and efficient treatment is necessary to obtain the best results. Even the patient who has had this type of arthritis for six weeks or more has still a 35 per cent. chance of being relieved of his painful symptoms. If he is not cured, this type of patient has an additional 30 per cent. chance of being markedly relieved with only some remaining stiffness. "Unfortunately germs supposed by many to cause the common forms of rheumatism (chronic deforming arthritis) are usually resistant to heat and apparently are not killed by the amount of fever which it is safe to induce in human beings. The development and poisonousness of these germs may be somewhat hindered, however, and circulation to the joints may be improved; hence, some of these patients with rheumatism also get relief from fever treatments, although not nearly so often as those who have gonorrheal arthritis." It was reported that, of about 315 patients with rheumatism who were treated in various clinics, 5 per cent. had been relieved of their symptoms and 25 per cent. had quite definitely been benefited.

COMPLETE rest, a very restricted diet and avoidance of the usual heart drugs will enable many patients to recover from heart attacks and return to a regular life, Dr. A. M. Master, of Mount Sinai Hospital, New York, told members of the American Heart Association. Nearly two thirds of the private patients so treated by Dr. Master and his associates, Drs. Harry L. Jaffe and S. Dack, are now able to lead normal lives. Another 12 per cent. have returned to light or moderate activity. Some of them are still living fifteen years after their first attack. Heart disease is not really increasing, in Dr. Master's opinion. He takes an optimistic view of the situation. The increase of heart deaths reported is partly due to better diagnosis and partly to the fact that more persons are living to old age, and it is only in the old age group that there is any real increase in deaths from heart disease. The stress and strain of modern life is not thought to be the cause of the increase of heart disease. Dr. Master pointed out that "there was just as much stress and strain in the Dark Ages, the days of the Huns, the plagues, the great fires, Spanish inquisition and the French Revolution as there was in the Great War or during the depression." The form of heart disease known as coronary artery occlusion has probably occurred just as frequently in the history of man as it does now. In this type of heart disease the arteries which supply the heart muscle itself with blood become so narrowed that the blood can not pass through the tiny vessels. Sometimes the vessels are stopped up by formation of blood clots. It is the latter form of the disease for which Dr. Master and associates

found the restricted diet and rest so successful a treatment.

CURING a severe and sometimes fatal disorder of the digestive tract "as if by magic" when the patients were relieved of worry was reported by Dr. Albert J. Sullivan, of Yale University School of Medicine, to the American Gastro-Enterological Association. These patients had previously been treated by all known medical means without any lasting improvement. The ailment is known medically as ulcerative colitis. Emotional factors cause about three quarters of all cases, Dr. Sullivan believes. Victims of the disorder, Dr. Sullivan found, appear to have many characteristics in common. Nearly all are between 20 and 30 years old. They have high intellectual capacity, are neat to the point of fussiness and are emotionally tense. Outwardly calm, they are unable to throw off the effects of an emotional episode as most people do. One patient described this common trait of the group by saying, "When I get into a quarrel or some unpleasant thing comes up, I stew over it for three or four days." The digestive disorder always starts within a few days of the emotional upset. This makes it comparatively easy to get at the root of the trouble without long psychiatric examination, as the physician needs only to discuss with the patient his state of feelings for the few days preceding the attack. Most patients recover completely as soon as they have talked freely to the doctor about their emotional difficulties. One or two who refused to talk about how they felt, or to admit that this could have anything to do with their physical illness, failed to recover from the condition. Emotion acting through certain nerve centers in the brain stimulates part of the digestive tract to such activity that it begins to digest its own surface, Dr. Sullivan suggested as an explanation of the nervous and mental cause of the disease. Once this digestive self-cannibalism has happened, disease germs can easily invade the digestive tissues and ulcers then form.

NEW knowledge of cancer and how it is caused may be found by study of the relation between cancer and age, Dr. C. C. Little, managing director of the American Society for the Control of Cancer, indicated in a report to the American Society of Clinical Pathologists. "The relationship between cancer and age is altogether too close to be considered as due to chance alone," Dr. Little said. "It undoubtedly has significance and will prove a fruitful field for further investigation." Cancer is relatively extremely rare during the rapid period of body growth in youth. It begins to become frequent during the period when the centralized control of the body, exercised by the glands of internal secretion, begins to weaken. This control weakens when the glands grow old, which they do with the passing of time just as the rest of the body does. As the glands grow old their secretion undoubtedly changes not only in amount but in its ability to do the work for which it was originally intended. As a result an unbalance is produced inside the body. The control of body activity which the glands exert at the peak of

their activity has weakened and it is at this point that cancer becomes frequent. Dr. Little did not say that the increase in cancer was due to this failure of the glands of internal secretion. But this appears to be one of the points which could be cleared up by the study he suggested of the relation between cancer and age. The common idea that cancer is a growth on some part of the body is wrong. The disease is uncontrolled growth of some part or parts of the body. The cancer is not a strange element introduced into the body by an outside agent, but a natural part of the individual possessing it.

MOST of the many blood tests for cancer are "perfectly valueless," Dr. I. Davidsohn, of Chicago, told members of the American Society of Clinical Pathologists. One that is particularly valuable, however, was developed by Dr. H. Fuchs, of Germany. This test diagnoses cancer correctly in between 85 and 95 per cent. of the cases, according to results in over five thousand tests made by many investigators in this country and abroad. The test depends on the presence of an enzyme in the blood of non-cancerous patients which can digest the fibrin or precipitate the serum from the blood of cancer patients. The digestion is determined by measuring the amount of a certain form of nitrogen in the blood. This latter is an ordinary laboratory test but because the change in level of this non-protein nitrogen, as it is called, is very slight in the cancer test, it is difficult to detect it by the usual methods. Dr. Fuchs has put out a special instrument for this purpose, which, however, is quite expensive. Dr. Davidsohn hopes that other scientists will investigate the Fuchs cancer test and perhaps find a way to make it more generally useful.

THE only way to determine intoxication positively, as in the case of drunken drivers, is by examination of the brain tissue after death or by examination of the spinal fluid in living persons, in the opinion of Dr. A. O. Goettler, of New York City. Dr. Goettler gave his opinion at the meeting of the American Society of Clinical Pathologists in answer to a question at the conclusion of his report on methods of detecting poison in children who had accidentally been given the wrong medicine or had themselves sampled the contents of the family medicine chest. Dr. Goettler and associates in the medical examiner's office of New York City do not believe that tests of the breath, blood or kidney excretion give definite evidence of intoxication. Such tests, he said, only show that "a man has partaken of alcohol."

VITAMIN E, known to be necessary to animals in producing their offspring, has also proved helpful to human mothers who desire children. Sixty-five human cases treated with the vitamin in a preparation of wheat germ oil were reported by Dr. Earle M. Watson, of the University of Western Ontario. This is said to be one of the few times when the vitamin has been used to treat human beings. Its existence and probable rôle in reproduction has been demonstrated in other animals, but there has been much doubt as to its rôle in human reproduction. Whether the vitamin can be used in medical practise re-

mains to be seen. The wheat germ oil preparation of vitamin E, made at the University of Western Ontario, was given to a group of mothers who had repeatedly been disappointed by losing their babies before time for natural birth; to another group threatened with the loss, and to others who had not been able to become mothers. Best results were obtained with the first two groups. Those who had previously not been able to have children were not helped by the vitamin treatment. Many of those who had repeatedly lost babies before birth, however, had normal children after the vitamin treatment.

DISORDER or disease of the nerves in the area around the appendix may be the cause of some cases of chronic appendicitis, according to Dr. Louis C. Simard, of Montreal. Dr. Simard bases his opinion on studies of all the appendixes removed at the Notre Dame Hospital, Montreal, between 1927 and 1931. He found an abnormal condition of the nerves in slightly over half the appendixes removed in cases diagnosed as chronic appendicitis. In those diagnosed acute appendicitis, only 9 per cent. showed these changes in the nerves. Another group of appendixes studied by Dr. Simard had been removed in the course of operation for some other condition. Nearly one third of the appendixes in this group showed nerve changes, which suggests that these were the cause of symptoms interpreted otherwise than as appendicitis.

CALLING posture "an attitude of mind," Dr. Armitage Whitman, of New York City, pointed out that the greatest emphasis must be placed on mental attitude in treating even such conditions as curvature of the spine. The patient should be treated first and the disease second, in his opinion. In some cases of curvature, definite permanent improvement may be obtained in direct ratio to the patient's intelligence. Curvature of the spine is the result of man's assuming the upright position and the consequent struggle against the force of gravity. Placing the patient on his back therefore removes this important factor in the cause of the condition and is one of the methods of treatment he recommended. No back is so crooked that it can not be improved by effort. Severe methods of correction of curvatures would be unnecessary if the importance of the mental attitude were more generally understood.

ONE of the fungus-like formations found on the skin in cases of ringworm and previously thought to be the cause of the disease is not really a fungus at all but is made up of crystals of a chemical substance, cholesterol. Evidence for this was reported by Drs. A. M. Davidson and P. H. Gregory, of the University of Manitoba, Winnipeg. This discovery makes it doubtful whether the newly identified crystals have any relation to ringworm infection. Mere presence of this crystal structure, which has been called "mosaic fungus" because of its pattern, obviously is not evidence of infection with the ringworm organism. Investigators had previously doubted whether the structure was a real fungus. The Canadian discovery shows that it is not.



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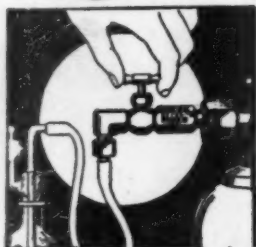
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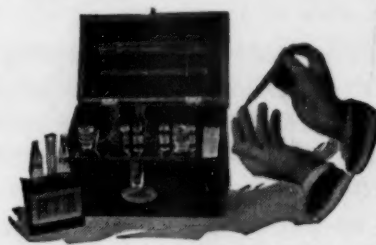
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MERCURY'S ATMOSPHERE

THE question of whether or not the tiny planet Mercury, innermost member of the sun's family, has a layer of atmosphere may be settled within two years when the planet just barely skims the face of the sun on May 11, 1937. Silhouetted against the sun for some forty minutes during this passage, astronomers will have the best chance in a thousand years to settle the baffling atmospheric problem of Mercury.

At present astronomers are divided on the question. Observationists believe that they have evidence that Mercury does have an atmosphere. Theoretical astronomers, however, have a number of reasons for thinking that the planet can not retain an atmospheric layer. The present controversy is summed up in the current issue of the *Journal of the British Astronomical Association* by C. O. Bartrum, secretary of the association.

When, at rare intervals, Mercury passes directly between the sun and earth in transit, there is an instant when the planet is half in front of, and half off, the solar disk. Then, the presence of an atmosphere may show itself by a ring of light which appears completely around the planet. The air on the edge of Mercury away from the sun would bend some of the light around it, just as the earth's atmosphere bends the sunlight so that we really continue to see the sun for a short time after it has set.

With the ordinary transit, such as last occurred in 1924, there is such a brief period, at the beginning and end, when Mercury is thus at the edge of the sun, that there is little time to make any detailed observations. The transit of 1937 will not be visible from England or northern Europe, for from these parts of the earth the planet will just miss coming in front of the sun. But in southeastern Europe and in Africa it will be seen, and there the planet will just skim along the sun's edge, hanging there for about forty minutes. Such a transit occurs but once in nearly a thousand years, and thus it should provide an excellent opportunity of studying Mercury at leisure to see whether there is the arc of sunlight around the portion not projected upon the sun's disk. "The presence or absence of such an arc would go a long way to settle the conflict between the planetary observers and the theoretical astronomers," according to the author of the note.

CHOLINE, A NEW VITAMIN

A NEW vitamin which is essential for liver function and which may play an important rôle in controlling diabetes was described at the Atlantic City meeting of the American and Canadian Medical Associations by one of its discoverers, Dr. C. H. Best, of Toronto, co-discoverer of insulin. The new vitamin has a real name, choline, instead of a letter as do most other members of the vitamin family. It is found in many foods, but the best sources are meat, egg yolk and yeast.

Dr. M. Hershey and Miss M. E. Huntsman, of the University of Toronto, were responsible for many of the

fundamental observations that led up to the discovery of the significance of choline, Dr. Best stated. Lack of this vitamin causes the serious condition of fatty liver. When the liver becomes fatty, it fails to make sugar or handle bile or do many of the things it should do.

The vitamin was discovered in the course of insulin investigations. Dogs that had no pancreas, the insulin-secreting organ, failed to live for more than a few months, even when given insulin injections. When they were fed minced pancreas, in addition to the insulin, they lived for years. However, chemical studies of the pancreas showed that in addition to producing insulin and a digestive ferment, this organ contained choline, and that it was the choline in the diet of minced pancreas that kept the dogs alive after they had lost their own pancreas. Cases of fatty liver in human beings, a serious condition of ill health, may be due to lack of choline in the diet; but Dr. Best did not discuss this point.

The choline discovery has thrown further light on the diabetes problem. The latter condition is a liver disorder rather than a disorder of the insulin-producing pancreas, it now appears. According to Dr. Best "The pancreas is not always to blame in cases of diabetes."

Diabetes may be caused in three different ways: the liver, as the result of injury or disease, may become too active and make too much dextrose sugar from the starches, sweets and proteins eaten; or the liver may become overactive due to lack of insulin (the usual explanation, though not necessarily the usual cause of diabetes); or, finally, the pituitary, thyroid and adrenal glands, either alone or in combination, may become overactive and affect the liver through their relation with the insulin-producing part of the pancreas.

The pancreas was evidently at fault in the first case of diabetes treated with insulin, that of Leonard Thompson, of Toronto. Following Mr. Thompson's death from pneumonia in April, 1935, autopsy examination showed remarkably few of the insulin-producing islet cells in the pancreas. This patient, who as a lad was dramatically rescued from danger of diabetes by treatment with some of the first insulin ever produced, grew careless about his diet when he grew older. As a result, he developed diabetic coma and then pneumonia. The physicians were able to relieve the diabetic condition again by insulin but they could not save him from the pneumonia.

LOWERED DIPHTHERIA DEATH RATE IN LARGE CITIES

A BRILLIANT lowering of the death rate from diphtheria in large cities of the United States is reported by the American Medical Association in its twelfth annual survey just completed. Only one section of the country—the east south central states—failed to share in the tremendous inroads being made against this enemy of childhood.

Fifteen large American cities of the ninety-three covered in the survey had not a single death from diphtheria during 1934. They are as follows: Cambridge, Mass.;

Canton, Ohio; Duluth, Minn.; Elizabeth, N. J.; Grand Rapids, Mich.; Long Beach, Calif.; New Bedford, Mass.; New Haven, Conn.; Salt Lake City, Utah; Seattle, Wash.; South Bend, Ind.; Spokane, Wash.; Springfield, Mass., and Syracuse and Utica, N. Y.

The ten cities with the lowest death rates from this disease in the last five-year period, according to figures published in the *Journal* of the American Medical Association, are: Grand Rapids, Mich.; Salt Lake City, Utah; Duluth, Minn.; Seattle, Wash.; Syracuse, N. Y.; New Haven, Conn.; Yonkers and Rochester, N. Y.; Spokane, Wash., and Long Beach, Calif.

Also listed are the ten cities with the worst health records as regards diphtheria: Lowell, Mass.; Louisville, Ky.; Knoxville, Tenn.; El Paso, Texas; Chattanooga, Tenn.; Nashville, Tenn.; Atlanta, Ga.; Jacksonville, Fla.; New Orleans, La., and Somerville, Mass. Baltimore, which had a high diphtheria death rate for 1925-1929, now not only leads the group of south Atlantic states but has one of the best rates among the thirteen cities of the country with more than 500,000 population. San Francisco and Philadelphia alone surpass it.

South Bend, Ind., has had its third successive year without a diphtheria death, a new record among American cities. Five cities reported that they had only one diphtheria death each, in 1934, and it occurred in a non-resident. These cities are Providence, R. I.; Worcester, Mass.; San Francisco and Long Beach, Calif., and Tacoma, Wash.

HUMAN HEREDITARY DEFECTS DUE TO MUTATION

HEREDITARY diseases and defects, such as hemophilia or "bleeders' trouble," are not always due to defective traits in the inheritance of the sufferer. Hemophilia is sometimes called the "king's disease" because the Spanish and Russian royal families have it as a hereditary factor.

A considerable number of all cases originate in persons with no family history of such defects, simply by mutation, or the tendency for new evolutionary characters to crop out in lines where they previously have not existed. This conclusion has been reached independently by two English scientists, Dr. L. S. Penrose, of the Royal Eastern Counties' Institution at Colchester, and Dr. J. B. S. Haldane, of University College, London, who have published their results jointly in *Nature*.

Two hereditary defects were studied: hemophilia, or the inability of the blood to clot, resulting in excessive bleeding from trifling wounds; and epiloia, a condition in which tumors of the skin, brain and sometimes of the heart and kidneys are liable to be associated with epilepsy and mental deficiency. Persons afflicted with either of these disorders naturally have a high mortality rate, and as a rule do not reproduce, at least in severe cases. Yet the number of hemophiliacs and epiloiaes remains distressingly large.

The explanation, in the opinion of Drs. Penrose and Haldane, is that these defects arise by mutation in previously healthy stocks. They estimate that in each generation about 25 per cent. of all cases of epiloia are

"sporadic and are presumably due to mutation." In the part of England covered by the study, about one person in every 30,000 of population has epiloia. This, the two investigators conclude, "implies a mutation rate of about one in 120,000 per generation."

Similarly, hemophilia, though an hereditary trait, is so disabling that the marriage rate of hemophiliacs is very low, and their reproduction rate presumably even lower. Dr. Haldane estimates that "the frequency of hemophilia in London males certainly exceeds one in 100,000 at birth and may well exceed one in 30,000. A rough estimate of the mutation rate is one in 50,000 to 100,000 per X-chromosome per generation."

This study is considered to be of importance far beyond its immediate medical and sociological interest. Hitherto there has not been even an approximate estimate of how fast the human race "mutates," although data on mutation in other organisms have been obtained. Drs. Penrose and Haldane, as one outcome of their studies, estimate that "man seems to be somewhat more mutable than *Drosophila*," the tiny insect most used in genetical researches.

THE PROMISE OF SEAPLANE SERVICE

DAILY transatlantic trips, by seaplanes triple the size of to-day's largest, were forecast for "the immediate future" by Igor I. Sikorsky, noted aircraft designer. Speaking before the meeting of the Society of Automotive Engineers meeting at White Sulphur Springs, W. Va., Mr. Sikorsky backed his prediction by citing the extremely rapid progress in seaplane design.

Here is the comparison between the Sikorsky S-40, which set payload seaplane records in 1931, and the S-42, now about to go into regular commercial service between Hawaii and California:

	S-40	S-42
Weight	21,000 lbs.	19,764 lbs.
Gross weight.....	34,000 lbs.	38,000 lbs.
Equipment	1,000 lbs.	2,181 lbs.
Payload	3,200 lbs.	8,363 lbs.
Cruising speed	115 m.p.h.	157 m.p.h.
Top speed	137 m.p.h.	182 m.p.h.

The important point in the development, Mr. Sikorsky pointed out, is the increase of 5,163 pounds in payload. Or, said another way, if equal payloads are considered, that is, 7,500 pounds, the range of the S-40 is 479 miles, while the range of the S-42 is 1,130 miles, an increase of 651 miles.

Even more striking for economical commercial flight is a comparison by what the aircraft engineers call the ton mile. If an airplane can lift a one-ton payload and cruise with it at 100 miles an hour for one hour, it is credited with a rating of 100 ton-miles. The Sikorsky S-40, on this basis, every flying hour receives credit for (1.65 tons × 115 miles) 189.75 ton-miles. The S-42, however, receives credit for (4.25 tons × 145 miles) 616.25 ton-miles. On this comparison the new S-42 is over three times as efficient.

Discussing how the future of transatlantic flying lies in the use of larger seaplanes, Mr. Sikorsky said: "Several conditions point to the usefulness of increased size

of future flying boats as compared with land transports. In the latter case, the great frequency of departure is of value because of the relative short distance to be covered, and it has been generally found that small ships can be used successfully. In the case of North Atlantic trans-oceanic flying boats, the frequency of departure is of less importance, as a tremendous saving in time is made, reducing perhaps the time involved from four or five days to 24 hours per trip. Needless to say, daily departures will be made.

"Eight professional men will be required for such 24-hour flights, not counting the stewards. Furthermore, the improved efficiency and seaworthiness with respect to the increased size of flying boats are indicative of the possibilities offered. Therefore it is probable that in the immediate future we shall see flying boats of up to 100,000 pounds; and in a decade or so flying boats of several hundred tons will probably make their appearance."

ITEMS

A METHOD of photographing heart sounds has been devised by three Iowa scientists: Dr. Walter Bierring, president of the American Medical Association; Dr. H. C. Bone and M. L. Lockhart, all of Des Moines. The apparatus, called the electrostethograph, is said to have advantages over other methods of recording heart sounds in current medical usage. It is described in the *Journal of the American Medical Association*. A viewing screen is used on which the vibrations from the heart can be seen at the same time the physician is listening to and photographing the heart sounds. This aids in obtaining good photographic records and in detecting certain abnormal sounds and locating their position in the heart cycle, a feature of particular aid in training medical students. The photograph provides a permanent record of heart action.

THE cause of acute rheumatic disease is probably a virus, Drs. Bernard Schlesinger and Gordon Signy, of the Hospital for Sick Children, and C. Russell Amies, of the Lister Institute, report in a recent issue of *The Lancet*. Microphotographs of fluids from the chest and lungs of persons dying of acute rheumatic infection revealed elongated bodies closely resembling those previously identified as the virus bodies of chickenpox. The microphotographs were taken and described by J. E. Barnard, fellow of the Royal Society. Tests with the blood serum of thirty-six living patients suffering from acute rheumatic disease confirmed the belief that the bodies seen in Mr. Barnard's microphotographs are the "germs" of the disease. The streptococcus, previously considered the microorganism that caused acute rheumatic disease, plays an important part in the development of the malady, probably by lowering the individual's resistance to the virus.

RIGID quarantine has been clapped down following a smallpox outbreak at Nabaiuna in the northwest district of the colony of Essequibo, British Guiana, approximately one hundred miles northwest of Georgetown. Report of the outbreak has just been received by the U. S. Public

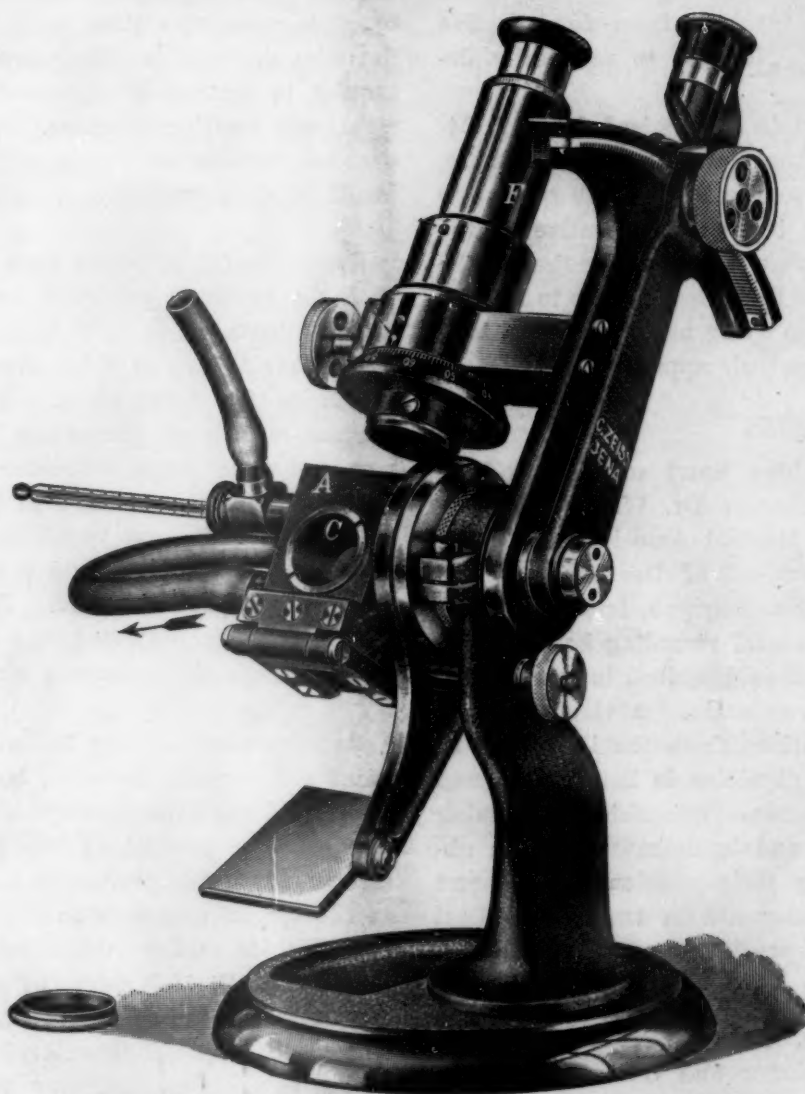
Health Service from the American consul at Trinidad. The outbreak is small and the disease occurring in mild form. Existing cases have been isolated and the rest of the district quarantined. First news of the epidemic reached federal health officials when a scientifically-minded official of an airline company noticed the word "serum" on a forty-five pound shipment being rushed over his company's lines from a Detroit manufacturing firm for delivery in Georgetown, British Guiana. His inquiry to Detroit brought out the fact that the shipment was smallpox vaccine. Suspecting a wide-spread outbreak because of the size of the shipment, the federal health officials promptly investigated.

EVER mindful of better ways to link European Russia with the far-flung provinces and cities like Vladivostok across Siberia, U. S. S. R. is completing plans for a new ice-breaker to convoy ships along the icebound northern sea route for 4,000 miles. It is proposed to install engines capable of generating 24,000 horsepower in the new ice-breaker which will make it over twice as powerful as the *S. S. Krassin*, rated at 10,000 H.P. With great fuel capacity the new vessel should be able to make the 4,000-mile trip in a single season without touching at intermediate ports for fuel. Further exploration of the Arctic ocean is projected, the vessel conducting freight ships through the hazardous stretch of sea.

BAGILUMBANG oil may be introduced in the American paint and varnish industry, benefited years ago by the coming of the more tersely-titled tung oil from China. The oil is a product of the Philippines, and the big-seeded fruits that produce it are now being raised on a small experimental scale in Florida. Oil extracted from these Florida seeds was demonstrated by Dr. G. S. Jamieson and R. S. McKinney, of the U. S. Department of Agriculture, before the American Oil Chemists' Society. The oil, a limpid, light-colored fluid, resembles tung oil in its valuable quick-drying properties. Bagilumbang trees prefer a limestone soil, in contrast to tung oil trees, which are grown most successfully in the hopeless-looking sandy soils of northern Florida and the Gulf Coast.

YOUR heart and your foot move to the same rhythm when you sit with your legs crossed. This natural, almost invisible, swing of the foot has suggested to a Baltimore doctor a new test for disease of the blood vessels of the legs. A preliminary report of the new test, devised by Dr. Bertram M. Bernheim, of the Johns Hopkins Medical School, will appear in the *Journal of the American Medical Association*. Dr. Bernheim attaches a short rod to the side of the shoe of the free leg. The pointed tip of this rod rests lightly against the revolving drum of an instrument that traces the swing of the leg. The less the swing, the more serious is the condition, according to his interpretation. The greater and more regular the swing, the better is the condition. While Dr. Bernheim is not certain of the cause for this, he suspects that the calf muscles spread according to the amount of blood sent to them and then contract again in a rhythm.

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THE APPROACHING ECLIPSE OF THE SUN

AN eclipse of the sun that begins the month after it ends is the paradoxical event coming soon. If you happen to be at a point in northeastern Siberia, at latitude 59 degrees 56 minutes north, and longitude 124 degrees 35 minutes east, on July 1, at the time your watch, set to standard time for that part of the world, indicates 2:34 A.M., the sun will rise. As it does so, you will soon notice that a small piece is nicked out of the edge, as the moon is starting to pass in front of it.

But Siberia is rather inaccessible, so instead you may prefer a point in the Atlantic Ocean, north of the Canary Islands, at latitude 46 degrees 43 minutes north, and longitude 23 degrees 19 minutes west, not far from the paths of some transatlantic steamers. If you are there on the late afternoon of June 30, you will also see the sun covered by the moon. If your watch is set to the proper standard time, as it reads 7:25 P.M., the sun will be setting, and the moon will be just at that moment passing from in front of the sun. This will bring to an end the partial solar eclipse that you might have seen start in Siberia early the next morning, and the next month!

All this sounds like some of the paradoxes that have been associated with the relativity theory by which, assuming it possible to travel faster than light, one could travel backwards in time. However, it is much simpler than that. It is a consequence of the International Date Line, that curious place in the Pacific Ocean where one day changes to the next. Every one knows that when it is noon in New York it is 11:00 A.M. in Chicago, 10:00 A.M. in Denver and 9:00 A.M. in San Francisco. Every time you travel 15 degrees of longitude to the west, you set your watch back an hour. Fifteen degrees is just one twenty-fourth the distance around the earth, so when you have gone completely around, your watch, if it had a calendar attachment, would indicate the preceding day. To avoid this, the International Date Line has been established, where, as you cross it from the eastern to the western side, you change immediately from one day to the next, thus compensating for the day you have gained around the west of the world.

Another way to think of it is to picture the day as starting at the date line, and then creeping around the earth from east to west, until it has encircled the globe, and then the next day starts, also at the date line. Consequently it is Monday, July 1, in eastern Siberia long before it is Monday in Europe or America. The total duration of the eclipse is less than three hours, so that it is over before the day has been able to catch up to it. The astronomer avoids any such confusion, as he expresses the hour of such events in Greenwich time, which is used in England, and five hours later than eastern standard. Thus the eclipse begins at 6:34 P.M., Greenwich time, and ends at 9:25 P.M., all on Sunday, June 30.

The paradox of the times of this eclipse is about the only thing to make it of more than passing interest. At no time, as seen from any part of the earth, will the moon

completely cover the sun, producing a total eclipse. It is only at the time of a total eclipse that the astronomers can make the observations for which eclipse expeditions are often sent half way around the earth. Even where the coming eclipse is seen at its height, less than a third of the sun's diameter will be covered. In addition to northern Siberia, it will be seen from the British Isles, Norway, Sweden, Greenland, Iceland and the north pole.

HEALTH PROTECTION

To reach every individual citizen of the United States with the scientific knowledge and scientific leadership necessary to protect health—this was the ideal held before the conference of State and Territorial Health Officers meeting at Washington to plan the expenditure of \$8,000,000 which it is expected that the Congress will appropriate in connection with the pending social security bill now before the Senate.

The money, if provided by the Congress, will be used to expand the present health services of the nation so that every individual community may develop an adequate service, according to the plans adopted by the conference. New services, including a maternal and child health program, will be provided for.

Half of the \$8,000,000 fund, or \$4,000,000, will be allocated to the states on a *per capita* basis. Of this amount, one half will be used to match, dollar for dollar, existing appropriations, and the other half will be used to match new appropriations that may be made by state legislatures as a part of this expanding health program.

Another thirty per cent. of the total fund, \$2,400,000, will be devoted to an attack on the special health problems of individual states, including the training of personnel so that they will be competent to handle them. The hookworm of the southern states and the malaria of mosquito-ridden regions are among the special problems that this fund will be used to combat.

Since properly trained personnel is one of the major problems in a battle of this sort, half of this \$2,400,000 fund will be devoted to the establishment of suitable training centers and the payment of the expenses of young professional men and women to fit them for this work.

Allocation of the remaining \$1,600,000 will be on the basis of financial need. A small part of this amount, \$400,000, will be distributed equally to all the 51 states and territories. The remainder, \$1,200,000, will be used for aiding those states least able to provide funds for adequate health service.

It is anticipated that not all the money available will be spent in the immediate future. Allocation of funds to a state will not necessarily mean that all the funds so allocated will be paid out. Careful plans will be made, and only such amounts approved for spending as can be wisely spent. The building of a permanent health service for the nation rather than a stop-gap care of the present emergency was emphasized.

THE USE OF WATER-ABSORBING SILICA GEL IN AIR CONDITIONING

A STRANGE substance which looks like sand but has the power to absorb water vapor from air and which seems destined to reduce the cost of air conditioning to within reach of average home owners, was described before the meeting of the American Society of Heating and Ventilating Engineers at Toronto by W. E. Stark, of Cleveland.

This substance, known as silica gel, was widely used in gas masks during the war to absorb poison gases. Until recently it was mainly a laboratory curiosity, although some of its properties have been familiar to science for many years. Its use in air conditioning is a new development where it has been proved to be an ideal dehumidifier.

Each crystal of silica gel consists of hard core surrounded by many submicroscopic pores which, while invisible, reveal their presence in laboratory experiments. The air conditioning device contains silica gel reactivated by passing ordinary natural or coke gases through.

Use of the new system may result in the simplification of air conditioning systems which up to now have been largely confined to large buildings because of the cost of installing the required equipment. Silica gel was envisioned as playing a leading rôle in lowering the cost and making air conditioning available to small residences.

The water-absorbing compound is now industrially used as a purifying agent in oil processing and for removing moisture from dry ice. It is also used medically in powdered form to absorb certain poisons from the intestinal tract. Professor Auguste Piccard carried silica gel on his stratosphere flights to keep the gondola free of moisture.

THE ABATEMENT OF NOISE

A NOISE ABATEMENT EXHIBITION in London has been arranged by the Anti-Noise League, formed eighteen months ago to reduce nerve-racking noises of all kinds. A full-size house has been built within the science museum to show the many methods and devices that can now be used to deaden sound.

External noise—the worst enemy—is defeated by having special ventilators whose long and tortuously curved air passages filter out such sounds as are not repelled by steel reflectors or absorbed by wood-fiber “baffles.” The double windows are kept closed.

To bring home the differences between ceilings that are sound-insulated and those at the other extreme of construction: the ground floor of the house has two small rooms side by side, separated by an air-space. The floor of the large room is continuous, but the portion above the first room is scientifically laid and insulated, while that above the second is the old, slap-down style of flooring. Across the entire floor walk two mechanical feet, back and forth. They are propelled by electrical mechanism, and each hits the ground with the force equal to the average pressure of a shod human foot. Visitors to the exhibition are invited to go first into one of the small downstairs rooms, then into the other. In the first

room they hear no footsteps overhead—nor, for that matter, the radio going full-blast in another downstairs room. But in the second room there is a loud and maddening “clump, clump,” rising and falling in intensity as the mechanical feet tread their unceasing measure.

The house has literally noiseless bells. The bell-pushes are linked through a newly-invented relay system with the electric lamp circuits. When the door “bell” is pressed in the daytime, no bell rings. Instead, on come the kitchen lamps. After dark the lamps—already on—flicker up and down until attention is called to them.

ITEMS

A NEW object in the heavens has been reported to astronomers throughout the world by the International Astronomical Union bureau at Copenhagen. The object may be either a comet or an asteroid. It was discovered by Dr. John Jackson, of the Royal Observatory, Cape of Good Hope, who was formerly chief assistant at Greenwich Observatory, England. Of the thirteenth order of astronomical brightness, the object is much too faint to be seen with the naked eye. It appears low in the southeast sky just north of the bright star Antares, in the constellation of Scorpius. The astronomical coordinates of the new object, which will be named after Dr. Jackson, are: right ascension, sixteen hours, forty-four and three-tenths minutes; declination, minus nineteen degrees and forty-eight minutes.

FLOODS in the Southwest are likely to continue, according to the rivers and floods division of the U. S. Weather Bureau. The Arkansas, already in high flood, is due to reach a stage of 33 feet. This is a close approach to its record of 36.7 feet, established in the great flood of 1927. The Rio Grande is also in flood, with fairly high stages in its lower course. There have been wide-spread and rather heavy rains in the Upper Mississippi basin, but as yet the only flood threat is in the Des Moines River, which is bank-full from Ottumwa, Iowa, to its mouth. In New England also there have been very heavy rains, but so far the short, steep-coursed rivers of the region have been able to pour their waters into the sea without raising any major mischief.

A NEW method of sorting out the good parts of what was formerly waste rock and hence make possible high-grade cements from low-grade material was described before the recent meeting of the American Institute of Mining and Metallurgical Engineers. Professor Benjamin L. Miller, of Lehigh University, and Charles H. Brierwood related how the oil flotation process, used widely in concentrating metal ores, can be applied to what was once considered low-grade cement rock. Flotation is the method of stirring crushed rock in a bath of foaming fluid. Each bubble in the foam attracts certain parts of the crushed rock or ore mass and carries it off. Thus the desired material is concentrated. For cement-making lime and alumina were desired. By the flotation method these were obtained and iron and silica rejected.

Three Important New Books

Dole—Principles of Experimental and Theoretical Electrochemistry

By MALCOLM DOLE, Department of Chemistry, Northwestern University. *International Chemical Series*. 536 pages, \$5.00.

Describes the principles of experimental and theoretical electrochemistry from the modern, mathematical-electrical point of view. The author discusses classical electrochemistry and the newer fields of electric moments, molecular rays, Debye solution theory, quantum mechanical theories, etc. Special attention is paid to recent advances in the fields of conductance, measurements and theory, transference numbers, and the mathematical theory of Debye and Hückel. The approach is new in that the author defines electrochemistry as that body of knowledge accumulated through the application of electric instruments and electric measuring devices, of electric and magnetic fields, etc., to the solution of the problems of chemistry.

Henderson and Fernelius—A Course in Inorganic Preparations

By WILLIAM E. HENDERSON, Professor of Inorganic Chemistry, and W. CONARD FERNELIUS, Assistant Professor of Inorganic Chemistry, The Ohio State University. *International Chemical Series*. 186 pages. In press.

These exercises in the preparation of pure compounds constitute an introductory course to advanced or graduate courses in inorganic chemistry. The material is organized around definite methods of procedure. *Inorganic Preparations* is not a recipe book; it seeks to broaden the student's knowledge of systematic inorganic chemistry, to provide training in the methods and technique of preparing pure inorganic substances, and to cultivate the habit of referring to original sources. Fundamental operations are stressed, and each step in the exercises is amplified by an adequate discussion of the principles involved.

Snodgrass—Principles of Insect Morphology

By R. E. SNODGRASS, Bureau of Entomology and Plant Quarantine, United States Department of Agriculture. *McGraw-Hill Publications in the Zoological Sciences*. 656 pages, \$6.00.

The chief importance of this new book is that it brings together in one volume a large body of significant material which is otherwise to be obtained only in widely scattered scientific journals, written in many languages. Designed as a guide to insect structures, the book presents the latest developments and ideas on insect morphology (including embryology and histology) and physiology. After a general review of the interrelated structures of annelids and arthropods, the book takes up the individual parts and appendages of the insect body and the internal system of organs.

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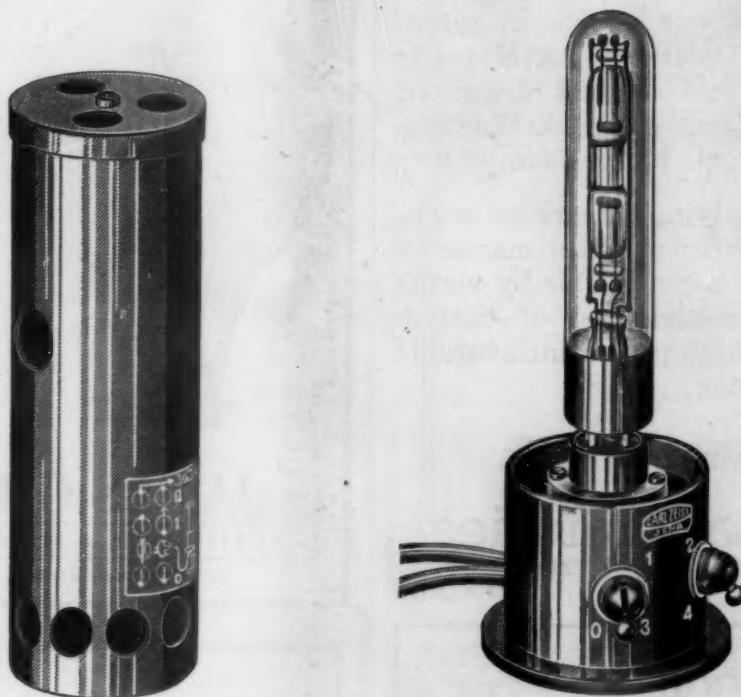
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